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INTRODUCTION

A COMPREHENSIVE INFORMATION SERVICE

The National Aeronautics and Space Administration makes the results of worldwide research and development activities in aeronautics, space, and supporting disciplines promptly available to participants in its programs. NASA's scientific and technical information system now contains nearly a million documents, which are abstracted, indexed, and obtainable through retrieval and dissemination services. These services, which include this abstract journal, *Scientific and Technical Aerospace Reports (STAR)*, are described fully in a bulletin, *The NASA Scientific and Technical Information System . . . and How to Use it*, available at no charge from the NASA Scientific and Technical Information Facility, P.O. Box 33, College Park, Maryland 20740.

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IAA is available on subscription from the American Institute of Aeronautics and Astronautics, Technical Information Service, 750 Third Avenue, New York, New York, 10017, at the following annual rates:

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Volume 9 Number 14 / July 23, 1971

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02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **2197**

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Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology. **2203**

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Includes communications equipment and techniques; noise; ratio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation. **2216**

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NASA ACCESSION NUMBER
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CORPORATE SOURCE
TITLE
LIMITATIONS IN THERMAL MODELING Technical Summary Report, 6 Jun. 1967 - 8 Dec. 1969
R. E. Rolling, D. O. Murray, and K. N. Marshall Dec. 1969
PUBLICATION DATE
245 p refs
AUTHORS
(Contract NAS8-21153)
(NASA-CR-102566; LMSC-6-78-69-41) Avail: NTIS CSCL 20M
AVAILABILITY SOURCE
An analytical and experimental study was made of the possible limitations existent in utilizing small-scale models for determination of spacecraft thermal behavior. A potential limitation in scale factor, experimental accuracy, and accuracy in model design is associated with each spacecraft design. Individual problem areas of thermal modeling are treated separately. Author
CONTRACT OR GRANT
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VOLUME 9 NUMBER 14 / JULY 23, 1971

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N71-25620# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.

HYPERSONIC FLOWS OVER LIFTING VEHICLES Final Scientific Report, 1 Sep. 1965 – 30 Sep. 1970

Martin H. Bloom and Robert J. Cresci Nov. 1970 64 p refs

(Contract AF 49(638)-1623)

(AD-719766; PIBAL-70-51; AFOSR-70-2881TR) Avail: NTIS CSCL 20/4

A summary of the research studies performed under AFOSR sponsorship for the period September, 1965 through September, 1970 is presented. The general problem areas considered deal with the following topics: (1) hypersonic, low density, viscous-inviscid interactions over various simple geometric shapes, (2) low speed, three-dimensional boundary layer behavior in a corner, (3) subsonic, laminar and turbulent mixing of two-dimensional, axisymmetric, and three-dimensional jets and wakes, and (4) several small scale studies involving advanced facility development, super-orbital satellite, etc. Most of these studies involve both experimental programs and complementary theoretical analyses in those areas where it is feasible. Author (GRA)

N71-25872*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

MACH 2.5 PERFORMANCE OF A BICONE INLET WITH INTERNAL FOCUSED COMPRESSION AND 40 PERCENT INTERNAL CONTRACTION

Joseph F. Wasserbauer and David A. Choby Washington May 1971 58 p refs

(NASA-TM-X-2294; E-6079) Avail: NTIS CSCL 20D

The inlet was designed to have the minimum internal contraction consistent with high total-pressure recovery and low cowl drag. Without a bypass system the inlet provided a critical pressure recovery of 0.880 and a steady-state distortion of 0.185 when the supercritical bleed flow was 0.032. With a bypass system in operation the critical pressure recovery increased to 0.903 and the steady-state distortion dropped to 0.10. Maximum angle of attack before an inlet unstart ranged as high as 9.4 deg. Author

N71-26062*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

STATIC AND DYNAMIC AERODYNAMICS OF SPACE SHUTTLE VEHICLES

Victor L. Peterson, Elliott D. Katzen, John A. Axelson, Jack J. Brownson, Donald L. Ciffone et al *In its* NASA Space Shuttle Technol. Conf., Vol. 1 Apr. 1971 p 311–373 refs (See N71-26051 14-31)

Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

Effects of Mach number, as well as chine radius and Reynolds number, on the aerodynamics of space shuttle vehicles at high angles of attack are considered for delta wing configurations having single and twin vertical tails. Resulting aerodynamic criteria for a wide range of shuttle configurations and test conditions show that: (1) aerodynamic stability designs must consider the effects of varying dynamic pressure and Mach numbers. Computer simulations can be utilized to determine which of the many derivatives have the greatest influence on flight behavior of space shuttle configurations. G.G.

N71-26065*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.

CONSIDERATION OF REYNOLDS NUMBER SIMULATION FOR SUBSONIC SHUTTLE TESTS

Thomas B. Sellers *In* NASA, Washington NASA Space Shuttle Technol. Conf., Vol. 1 Apr. 1971 p 423–453 refs (See N71-26051 14-31)

Avail: NTIS HC $9.00/MF $0.95 CSCL 20D

The Reynolds number simulation requirements for conducting subscale wind tunnel tests of space shuttle aerodynamic configurations are reviewed, and conclusions are reached that apply to the acquisition of data at angles of attack from zero to 90 degrees. Methods for qualitatively evaluating effects of simulation deficiencies are presented. It is shown that uncertainties inherent in high angle of attack stability data may be greatly reduced by extending the existing two-dimensional cross-flow coefficient data base. At low angles of attack, requirements for developing methods for predicting the onset of discernible viscous components, and relating the strength of that component to Reynolds number, are cited. Author

N71-26066*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.

CORRELATION OF SPACE SHUTTLE APPLICABLE EXPERIMENTAL HYPERSONIC AERODYNAMIC CHARACTERISTICS WITH THEORY

Richard K. Hamilton *In* NASA, Washington NASA Space Shuttle Technol. Conf., Vol. 1 Apr. 1971 p 455–492 refs (See N71-26051 14-31)

Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

Hypersonic theoretical-experimental correlations of aerodynamic characteristics pertinent to straight and blended delta wing shuttle designs are presented. The results substantiate the usefulness of the theoretical techniques in supporting the assessment of the hypersonic aerodynamic coefficients for delta wing shuttle designs. The use of the Hypersonic Arbitrary Body Program (HABP) also provides confidence in configurations as they are entered into

the wind tunnel program. Emphasis is placed on those aerodynamic characteristics which are influential with respect to the shuttle design. Characteristics correlated are shown on the slide. Areas of exceptional agreement will be noted as well as instances where deviations exist. Oil flow visualization studies complement the analysis. Author

N71-26129# Royal Aircraft Establishment, Farnborough (England).
AERODYNAMIC FORCES ON AUTOCABS, APPENDIX M
K. T. Shaw *In its* Cabtrack Studies: Assessment of Autotaxi Urban Transport Systems Jan. 1969 p 123–128 refs (See N71-26116 14-34)
Copyright. Avail: NTIS

Autocabs may be subject to substantial aerodynamic forces when operating in windy conditions although the cab speed may be relatively low. These forces can have a considerable effect upon the power required to maintain particular acceleration profiles and upon the vehicle track required for lateral stability. The effect of the yawing moment on longitudinal stability could limit the types of guidance system which are acceptable. Some preliminary estimates of the aerodynamic forces and moments to which an Autocab may be subjected, over a range of cab and wind speeds within which a Cabtrack system in Central London may operate are presented. The estimates refer to an idealized cab running on a flat road surface of unlimited width and do not take into account the effects of flow disturbances produced by particular track configurations. Author

N71-26170*# Princeton Univ., N.J.
TURBULENCE AND LATERAL-DIRECTIONAL FLYING QUALITIES
James A. Franklin Washington NASA Apr. 1971 344 p refs (Contract NSR-31-001-104)
(NASA-CR-1718; Rept-890) Avail: NTIS CSCL 01B

Trends in pilot rating obtained in the test program for variations in turbulence disturbances and airplane dynamics are explained in terms of measures of precision of task performance, pilot control workload, and pilot compensatory behavior derived from time histories of the flight evaluations. Pilot-vehicle systems analyses substantiate the performance-workload data and provide a more fundamental understanding of the heading control task in turbulence. The significant influence of turbulence on the evaluation task was found to be the rms disturbance magnitude, with yaw disturbances having a more profound effect than roll disturbances. Spectral bandwidth had less bearing on flying qualities than disturbance magnitude. Reductions in either roll damping or directional stability adversely affected flying qualities. Additional roll damping and directional stability were desired when the level of turbulence was increased. Data obtained for variations in aileron yaw indicate that favorable yaw is detrimental to the heading tracking task, particularly for low directional stability and when roll disturbances due to turbulence are large. Author

N71-26249 Utah Univ., Salt Lake City.
DYNAMICS OF SMALL SPHERES MOVING AT LOW SUBSONIC VELOCITIES IN LOW DENSITY AIR
Larry Arthur Mathews (Ph.D. Thesis) 1970 226 p
Avail: Univ. Microfilms Order No. 70-11938 CSCL 20D

The primary objectives of this investigation were to determine if moderately unsteady-state motion in low density gases influenced sphere drag coefficients at low Reynolds numbers and to extend the drag characterization of spheres to Reynolds numbers of order one in the slip regime of Knudsen flow. The drag characteristics of single, unrestrained, small spheres impulsively propelled into stagnant low density air were studied. Sphere trajectories were photographed with the use of a stroboscope having accurately determined flash frequencies of 60 to 280 per second. The successive image positions were determined by making precise measurements of the photographic negatives on an optical comparator. Sphere velocities and accelerations or decelerations were obtained by numerically differentiating the positions versus time data. Dissert. Abstr.

N71-26354*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HYPERSONIC AERODYNAMIC CHARACTERISTICS OF DL-4 LIFTING ENTRY VEHICLE
Charles L. Ladson Washington Apr. 1970 44 p refs
(NASA-TM-X-1994; L-6592) Avail: NTIS CSCL 01A

Aerodynamic forces on a representative, high-performance, entry configuration with a lift-drag ratio of about 3 have been obtained at Mach numbers of 6 and 10 in air and 20 in helium. These data are compared with theory to identify areas in which the theoretical methods are adequate and the areas in which improvement is necessary. Experimental results of Mach 10 tests of tip-fin and body modifications are also presented to show the attempts that have been made to develop a configuration which is stable about all axes. Author

N71-26355*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSES OF COOLED TURBINE AIRFOIL CONFIGURATIONS AT CONDITIONS OF SUPERSONIC FLIGHT
Francis S. Stepka Washington Apr. 1969 77 p refs
(NASA-TM-X-1782) Avail: NTIS CSCL 01A

The results of an analysis of various first stage turbine stator vane and rotor blade cooling designs which would have application to engines of aircraft for high-speed flight such as a supersonic transport are presented. Also summarized are the influence of various factors on cooling design and performance of turbine vanes and blades. These included use of future high-temperature materials, use of higher material thermal conductivity, changes in design geometry, changes in combustor gas temperature profiles, foreign object damage, and the effects of steady-state and transient engine and flight conditions. Author

N71-26583 Rochester Univ., N.Y.
A MODEL FOR THE WAKE GEOMETRY OF THE LIFTING ROTOR IN FORWARD FLIGHT AND AN EVALUATION OF THE SENSITIVITY OF COMPUTED BLADE LOADS TO THE WAKE GEOMETRY
Mukund Madhav Joglekar (Ph.D. Thesis) 1969 241 p
Avail: Univ. Microfilms Order No. 70-2877

Assuming that a helicopter rotor in forward flight can be represented by a flat circular disk with an appropriate steady pressure discontinuity across it, expressions were developed for relating the pressure field to: (1) the total aerodynamic thrust and the total steady pitching and rolling moments experienced by the rotor; or, (2) the time dependent aerodynamic flapping moments at the roots of the blades as they rotate. The selected pressure field satisfies: (1) the requirement of a loss of lift at the center and periphery of the disk, (2) accounts for first and second azimuthal harmonic variations in the lift density, and (3) satisfies Laplace's equation. A digital computing program was written for calculating the velocity field from the selected pressure field and for calculating the streamlines emanating from points above the disk. Two sample cases were chosen, corresponding to the UH-1 two-bladed teetering rotor at advance ratios of 0.26 and 0.08 respectively. Dissert. Abstr.

N71-26709*+ National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY, SUPPLEMENT 2
1971 122 p refs

(NASA-SP-7037-(02)) Avail: NTIS CSCL 01A

This special bibliography lists 394 reports, articles, and other documents introduced into the NASA scientific and technical information system in January 1971. Emphasis is placed on engineering and theoretical aspects for design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and development in aeronautics and aerodynamics and research and ground support for aeronautical vehicles. Author

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N71-25621# Center for Naval Analyses, Arlington, Va. Inst. of Naval Studies.

GENERAL AVIATION, NAVAL AVIATION AND CONGESTION WITH AN EXAMPLE FROM SOUTHERN CALIFORNIA

Stuart G. Schmid Jan. 1971 32 p refs *Its* INS Res. Contrib. No. 154

(Contract N00014-68-A-0091)

(AD-719906) Avail: NTIS CSCL 1/2

Federal Aviation Authority projections of general aviation activity for 1980 show a 75 percent increase over 1969 levels. Such growth will cause a substantial increase in general aviation traffic in airspace over metropolitan areas, creating difficulties for present users of airspace including the Navy. This paper describes a simple computational model used to translate projected general aviation growth into implied densities and aircraft interaction frequencies. The model is applied to Southern California and a case study is made of Miramar NAS at San Diego. The study shows that Navy operations there will be seriously hampered by general aviation traffic within the decade unless stricter air traffic controls are imposed. Such controls are probably justifiable considering the costs of moving Navy operations out of Miramar in comparison to the costs to general aviation of staying clear of prescribed Navy airspace. Author (GRA)

N71-25622# Army Foreign Science and Technology Center, Washington, D.C.

AIRCRAFT ANTI-ICING SYSTEM: PRINCIPLES OF DESIGN AND TEST METHODS

V. S. Savin et al 26 Jan. 1971 380 p refs Transl. into ENGLISH of the book "Protivoobledenitelnye Sistemy Letalelnykh Apparotov: Osnovy Proektir. i Metody Ispytanii" Moscow, Mashinostr., 1967 p 1-320

(AD-719922; FSTC-HT-23-411-69) Avail: NTIS HC $6.00/MF $0.95 CSCL 1/3

Theoretical fundamentals and practical methods of calculating and testing anti-icing systems (AIS) of aircraft and helicopters are described. Based on generalizations of results of experimental research, the meteorological conditions under which icing of aircraft and power plant is possible are pointed out, and the conditions that must be taken as calculation basis in designing AIS are set forth. The unfavorable effect of various forms and types of icing on stability and control of aircraft and engine performance is discussed. Approximation methods of calculating the dimensions of icing zones are presented. Present-day mechanical, physico-chemical, and thermal anti-icers are briefly examined and criteria for evaluating them when designing AIS are proposed. Principal attention is paid to electro-thermal and preheat-air systems, for which detailed methods of heat calculations are spelled out. Methods and techniques of testing AIS under full-scale and artificial icing conditions are described and tests with icing simulators are analyzed. Author (GRA)

N71-25846# General Precision, Inc., Binghamton, N.Y. Link Group.

A COMPARISON OF PILOT PERFORMANCE USING A CENTER STICK vs SIDE ARM CONTROL CONFIGURATION Technical Report, May - Oct. 1968

Richard Geiselhart, Paul Kemmerling, James E. Cronburg, and David E. Thorburn Wright-Patterson AFB, Ohio AFSC Nov. 1970 54 p refs

(Contract F33615-68-C-1097)

(AD-720846; ASD-TR-70-39) Avail: NTIS CSCL 1/3

Six Air Force pilots having current flying status flew a series of forty-minute missions to compare pilot performance with the conventional center stick, dual side stick, and single side stick configurations. An F-111 flight simulator with three degrees-of-motion was employed as the test-bed for the experiment. The missions, which included climbout, a terrain following portion, two banking turns, and five Instrument Landing System (ILS) approaches, were designed to test the feasibility of side stick controllers under low-altitude, high-speed conditions. Course steering deviation, airspeed deviation, pitch deviation, and ILS evaluation scores were obtained using the computer to compare pilot performance using the three stick configurations. From the evaluation of the performance data and opinion questionnaires filled out by the pilots, it was concluded that side stick controllers are feasible for use in a relatively high-speed aircraft flying a low-altitude, high-speed mission, and that dual side sticks are preferable to single side sticks. Recommendations were made for further studies in several areas. Author (GRA)

N71-25965# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

TECHNICAL MAINTENANCE OF AIRCRAFT [TEKHNICHESKAYA EKSPLUATATSIYA LETATELNYKH APPARATOV]

A. I. Pugachev et al 15 Jan. 1971 633 p refs Transl. into ENGLISH from the Russian

(AD-720366; FTD-MT-24-110-70) Avail: NTIS HC $9.00/MF $0.95 CSCL 1/3

Basic questions on the theory, practice and organization of technical maintenance of aircraft of civil aviation are stated. Application of methods of flow planning, the theory of mass servicing and the theory of reliability in solving problems of technical servicing are considered. Basic rules are started for the maintenance of aircraft and special features of their servicing under various climatic conditions. Questions regarding provision of operational technical facilities for aircraft and foreign experience in the organization of technical servicing are elucidated. Data regarding methods and means of control and mechanization of processes of technical servicing are set forth. In the book questions of flight operations of aircraft are stated: the organization and provision of flights, maintenance of aircraft at various stages, under specific conditions and cases of flight, methods of determination of load, and centering, and of fuel consumption, and methods of analyzing flying accidents. Author (GRA)

N71-26032# National Transportation Safety Board, Washington, D.C.

AIRCRAFT ACCIDENT REPORT: COMPANIA ECUATORIANA DE AVIACION DOUGLAS C-54D, REPUBLIC OF ECUADOR, HC-AON: MIAMI INTERNATIONAL AIRPORT, MIAMI, FLORIDA, 14 APRIL 1970

Dec. 1970 27 p ref

(NTSB-AAR-71-2) Avail: NTIS

A Douglas C-54D, of Ecuadorian registration, crashed at Miami International Airport, Miami, Florida, at approximately 0724 e.s.t., April 14, 1970. The aircraft was being operated as an international cargo flight by Compania Ecuatoriana de Aviacion. The accident occurred during the initial climb, following an instrument takeoff at Miami International Airport. The flight was en route from Miami to Panama City, Panama, the first leg of a flight which was to terminate at Quito, Ecuador. The two pilots, the only occupants of the aircraft, were killed, and the aircraft was demolished by impact and postimpact ground fire. Author

N71-26110* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

DIRECT LIFT CONTROL SYSTEM Patent

Joseph W. Stickle, inventor (to NASA) Issued 27 Apr. 1971 4 p Filed 20 Jun. 1969 Cl. 244-42; Int. Cl. B64c21/08

(NASA-Case-LAR-10249-1; US-Patent-3,576,301; US-Patent-Appl-SN-835060) Avail: US Patent Office CSCL 01C

A direct lift control system is proposed which is associated with existing control mechanism on most aircraft, and particularly applicable to light-weight aircraft. This is accomplished by forming a slot through to the flap associated with the wing. When the flap is deflected, air is forced through the slot opening in the lower surface of the flap and discharged at the slot opening at the upper surface of the flap, this spoils the airflow over the flap thus reducing lift. Tests have shown that this arrangement has little effect on drag, since the actual shape of the airfoil flap combination has not been changed to any degree. In addition, closure mechanisms are introduced for varying the size of the slots to regulate the degree of spoiling of the flap induced lift and the resultant direct lift control. Author

N71-26183*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

LOW SPEED AERODYNAMIC CHARACTERISTICS OF A LARGE SCALE STOL TRANSPORT MODEL WITH AN AUGMENTED JET FLAP

Anthony M. Cook and Thomas N. Aiken Mar. 1971 89 p refs

(NASA-TM-X-62017) Avail: NTIS CSCL 01A

An investigation was made to study the aerodynamic characteristics of a large scale model equipped with an augmented-jet flap and underwing cruise engines with deflectable thrust capability. The augmented-jet flap is a jet flap with the primary jet thrust increased by means of a spanwise ejector system installed in the wing trailing-edge flap. The flap installation was on the inboard part of the wing, with blown ailerons outboard. Primary configurations tested were those selected previously for landing approach and takeoff, for direct application of the data to a proposed flight research aircraft. Assessment was made of the effects of the underwing engines and nacelles with variations in thrust magnitude and direction. The effects of fuselage BLC were also measured. In addition, several methods of lateral control were investigated to obtain measurements of lateral derivatives and roll control power. The tests were made with and without the horizontal tail at a wind tunnel dynamic pressure of 383 newtons per square meter (8 pounds per square foot), corresponding to a Reynolds number of 2.9 million. The range of jet momentum coefficients was 0 to 1.07. Author

N71-26194# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

AVIATION EQUIPMENT AND AIRCRAFT ARMAMENT Final Report

29 Jan. 1971 28 p refs

(AD-720570; MTP-7-4-005) Avail: NTIS CSCL 1/3

Procedures are described for determining the ability of aviation equipment and aircraft armament to withstand storage and operate effectively in a tropic environment. Author (GRA)

N71-26195# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

RESCUE EQUIPMENT, AIRCRAFT CRASH Final Report

27 Jan. 1971 25 p refs

(AD-720563; MTP-7-3-090) Avail: NTIS CSCL 6/7

Procedures are identified for evaluation of aircraft borne aircraft crash rescue equipment under simulated tactical conditions. Helicopter mounted rescue hoists and accessories are also included. Author (GRA)

N71-26303# Hydrospace Research Corp., Rockville, Md.

AIRCRAFT NOISE TYPE CERTIFICATION ORIENTATION SESSIONS: FAA PRESENTATIONS, SUPPLEMENT 1 Final Report

Oct. 1970 70 p refs Presented in Washington, D.C., 5 Aug. 1970, Conf. held in Washington, D.C., Rockville, Md., and Atlantic City, 5–12 Aug. 1970; sponsored by FAA

(Contract DOT-FA70WA-2446)

(HRC-TR-300-Suppl-1) Avail: NTIS

The proceedings of a conference to train personnel in techniques for conducting aircraft noise certification are presented. Subjects discussed are: (1) development of noise rules, (2) aircraft noise measurements, (3) aircraft noise evaluation, (4) data reduction, and (5) flights to determine maximum sideline noise measurement points. Author

N71-26304# Hydrospace Research Corp., Rockville, Md.

AIRCRAFT NOISE TYPE CERTIFICATION ORIENTATION SESSION Final Report

John F. Waters and Ray E. Glass Oct. 1970 29 p refs Conf. held in Washington, D.C., 5 Aug. 1970, in Rockville, Md., 6–7 Aug. 1970, and in Atlantic City, 10–12 Aug. 1970; sponsored by FAA

(Contract DOT-FA70WA-2446)

(HRC-TR-300) Avail: NTIS

During the period 5 through 12 August, 1970, an aircraft noise type certification measurements orientation session was conducted for the Federal Aviation Administration (FAA). The purpose of the orientation session was to familiarize FAA personnel with the acoustic measurement techniques and procedures involved in the noise certification of aircraft under Federal Aviation Regulations. Personnel from the FAA regional offices are actually involved in aircraft noise type certifications. Author

N71-26306# Hydrospace Research Corp., Rockville, Md.

AIRCRAFT NOISE TYPE CERTIFICATION ORIENTATION SESSION: LECTURE NOTES, SUPPLEMENT 2 Final Report

John F. Waters, John V. McFadden, and Ray E. Glass Oct. 1970 98 p ref

(Contract DOT-FA70WA-2446)

(HRC-TR-300-Suppl-2) Avail: NTIS

Details of the techniques and procedures for measuring the effective perceived noise level (EPNL) during aircraft noise type certifications are presented. EPNL values are averages based on at least six takeoff and six landing measurements. Allowable EPNL values are given as a function of maximum aircraft weight. Several EPNL tradeoffs are allowed to provide some margin for excesses. Author

N71-26416*+ Boeing Co., Renton, Wash. Commercial Airplane Div.

STATIC TESTS OF A 0.7 SCALE AUGMENTOR WING FLAP FOR THE MODIFIED C-8A AIRPLANE: TEST RESULTS AND ANALYSIS

D. L. Harkonen, C. F. Wintermeyer, and F. L. Wright May 1971 296 p refs
(Contract NAS2-6025)
(NASA-CR-114315; D6-24850) Avail: NTIS CSCL 01C

A static test investigation was made of an augmentor-wing flap system for the modified C-8A jet STOL research airplane. Tests were conducted using a 0.7 scale model which had a wing span of 95 inches, a flap chord of 30 inches, and a full span double slot nozzle. Flap surface static pressures and total pressures within the augmentor were measured. The augmentor performance was found to be sensitive to the flap coanda surface position and flow blockage within the augmentor. Nozzle total pressure ratio was also an important parameter. The optimum flap pivot point for the aircraft was determined. The augmentation ratios with this pivot point location were near the maximum measured for flap angles from 30 to 65 degrees. The maximum augmentation ratio, based on isentropic thrust at the duct entrance, was 1.27 at 30 degrees flap angle. The corresponding augmentation ratio based on actual nozzle performance was 1.39. As the augmentor passage was blocked off by a moveable segment of the flap, the thrust of the augmentor decreased until slightly negative thrust occurred with the passage completely blocked. Author

N71-26417*# Boeing Co., Seattle, Wash. Commercial Airplane Group.
PARAMETRIC STUDIES OF THE ACOUSTIC BEHAVIOR OF LINED DUCTS AND DUCT LINING MATERIALS FOR TURBOFAN ENGINE APPLICATIONS
J. Atvars Mar. 1971 216 p refs
(Contract NAS1-10272)
(NASA-CR-111887) Avail: NTIS CSCL 01C

A flow-duct test facility was developed to simulate turbofan engine bypass duct geometry and noise environment in the laboratory. The facility was used to study the effects of various parameters of sound-absorbent wall liners. The liners consisted basically of a honeycomb sandwich and a porous face sheet. A description is given of the flow-duct test facility and the data reduction techniques, along with a listing of the reduced test results. Analyses of the test data showed that the significant design parameters are the face sheet impedance, treatment length, treatment depth, honeycomb cell dimensions, duct size, number of walls lined, number of layers in the linings, air velocity, and direction of flow with reference to sound propagation. The influence of these parameters is discussed. For simple single-layer linings, a design technology was developed by means of empirical equations. Experimental results show that this technology is valid for duct sizes (or lining separations) from 4 to 12 in., lining depths of 0.25 to 1 in., and duct airflow Mach numbers from −0.4 to +0.4. It is concluded that the flow-duct facility is a useful tool for investigating the basic properties of acoustically lined ducts. Author

N71-26528# Civil Aeronautics Board, Washington, D.C.
AIR PASSENGER TRAFFIC IN SHORT-HAUL MARKETS
Max H. Burstein and Donna M. Kaylor Mar. 1971 106 p
Avail: Issuing Activity

The magnitude, growth, and carrier participation of passenger traffic in major short-haul markets (those under 500 miles) are analyzed. Concise and manageable information relating to growth, competition, and concentration of passenger traffic in short-haul markets, by distance intervals and individual markets, is presented. Author

N71-26529# Commerce Dept., Washington, D.C. Economic Development Administration.
THE EFFECT OF AIRLINE SERVICE ON MANUFACTURING GROWTH IN CITIES BELOW 40,000 POPULATION
Leonard F. Wheat May 1970 39 p refs
Avail: Issuing Activity

The effect of commercial airlines on the locational calculus of industry is discussed. The hypothesis that cities with air service experience faster manufacturing growth is explored. The principal finding is that, under certain conditions, airline cities grow appreciably faster. Author

N71-26538# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STABILITY AND CONTROLLABILITY OF SUPERSONIC AIRCRAFT
V. Lutskii et al 4 Dec. 1970 10 p Transl. into ENGLISH from Aviatsiya i Kosmonavtika (Moscow), no. 5, 1970 p 34–35
(AD-720740; FTD-HC-23-601-70) Avail: NTIS CSCL 1/3

A general description is given of methods by which a pilot can control the lateral motion of a supersonic aircraft. GRA

N71-26567# Forsvarets Forskningsanstalt, Stockholm (Sweden). Avdelning 2.
MEASUREMENT OF A HELICOPTER'S GYRO DISPLACEMENTS IN SOME DIFFERENT FLYING CONDITIONS [MAETNING AV HELIKOPTRARS GIRROERELSER I NAGRA OLIKA FLYGFALL]
C. Borg and B. Hoegman Nov. 1969 43 p refs In SWEDISH
(FOA-2-C-2356-49-(72)) Avail: NTIS

Measurements of rotations recorded at the helicopter school in Boden are reviewed as a basis for building a simulator for the study of the helicopter's pilot's capacity to guide collimation guided ATGW from helicopters. The measurements were made with the rate gyro giving angular acceleration and were registered on tape. These signals were later integrated to give the angular deflection. Results are presented in tables and curves for angular rate and deflection. Author

N71-26776*# Winzen Research, Inc., Minneapolis, Minn.
[POLYETHYLENE BALLOON FABRICATION AND SPECIFICATIONS] Final Report
17 May 1971 17 p
(Contract NAS9-10496)
(NASA-CR-115026) Avail: NTIS CSCL 01C

The polyethylene balloon fabrication was completed. A time/altitude curve is prescribed which shows the data collected from instrumentation during the flight tests of two balloons. Author

N71-26790*# Winzen Research, Inc., Minneapolis, Minn.
[AN OPERATIONAL SUPER-PRESSURE BALLOON SYSTEM TO CARRY 50 POUNDS TO 10 MILLIBAR ATMOSPHERIC PRESSURE] Final Report
21 May 1971 25 p
(Contract NAS9-9745)
(NASA-CR-115027) Avail: NTIS CSCL 01C

The results of tests conducted during the balloon development program are discussed and conclusions based on the results are given. In regard to the strength integrity of the balloon system, it was concluded that a triangular panel configuration for gore reinforcement using interlocking load lines has distinct advantages over a rectangular configuration using circumferential load tapes. Other recommendations concerning efforts for further development of the system are offered. D.L.G.

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N71-25651# Argonne National Lab., Ill.
DEVELOPMENT OF HIGH-ENERGY BATTERIES FOR ELECTRIC VEHICLES Progress Report, Feb. 1969–Jun. 1970
E. J. Cairns, M. L. Kyle, V. A. Maroni, H. Shimotake, R. K. Steunenberg et al Jul. 1970 54 p refs
(Contract W-31-109-eng-38)
(ANL-7756) Avail: NTIS

The applicability of lithium/chalcogen cells to secondary batteries for vehicular propulsion is being investigated. During this period, cathode materials containing sulfur, P_4S_{10}, and P_4S_3 were tested in cells operated at 325 to 400 C. Liquid-electrolyte lithium/sulfur cells have exhibited capacity densities from 0.1–0.2 A-hr/sq cm at a current density of 0.5 A/sq cm. Sulfur utilization has usually been less than 35%. Cathode current-collector structure was found to have a significant effect on cell performance. Improved capacity density, near 0.5 A-hr/sq cm at a current density of 0.5 A/sq cm, was achieved by means of a laminated cathode structure. Potential construction materials for lithium/sulfur cells were subjected to 600-hr corrosion tests at 375 C. Molybdenum, chromium, and niobium showed corrosion rates sufficiently low for use in cells of anticipated lifetimes greater than 1000 hr.
Author (NSA)

N71-25958# Atomics International, Canoga Park, Calif.
BASIC RESEARCH IN THERMIONIC ENERGY CONVERSION Technical Summary Report, 1 Dec. 1969–30 Nov. 1970
Charles Warner and Lorin K. Hansen Feb. 1971 200 p refs
(Contract N00014-70-C-0198)
(AD-720407; AI-71-9) Avail: NTIS CSCL 10/2

The report presents some of the results of the past years work in a continuing study of thermionic converters. It is a study of the basic processes in thermionic diodes, and the application of this basic information to the achievement of practical thermionic energy conversion. The studies presented are: Cesium Adsorption measurements; Cesium Adsorption Study Using Ellipsometry and Auger Spectroscopy; Cesium Structure on Tungsten; Cesium Adsorption Theory at Higher Coverages; and Non-Saturation Phenomena in Thermionic Converters Collector Carbon Deposits.
Author (GRA)

N71-26016# Foote Mineral Co., Exton, Pa.
ACTIVE ENERGY STORAGE MATERIALS FOR INTEGRATED CELL STACKS Technical Report, 1 Jul. 1970–15 Jan. 1971
John H. Fishwick and Charles E. Dremann Mar. 1971 31 p refs
(Contract DAAB07-70-C-0173)
(AD-720600; ECOM-0173-1) Avail: NTIS CSCL 10/3

The objective of the program is to develop suitable inorganic separator materials capable of continuous and protracted operation in contact with molten lithium metal and a fused LiCl-KCl eutectic. The report describes the preparation and properties of seven materials based on the cations Li and Ca and aluminate and zirconate anions. It also describes the manufacture of test pieces from the seven materials and the preliminary results of an exploratory test performed under vacuum at 590C for 96 h. An extensive bibliography is included.
Author (GRA)

N71-26018*# TRW Systems Group, Redondo Beach, Calif.
ELECTRONIC SOLAR ARRAY SIMULATOR Final Report, 30 Jun. 1969–2 Nov. 1970
R. Von Hatten Nov. 1970 66 p ref
(Contract NAS5-21034)
(NASA-CR-118506) Avail: NTIS CSCL 10A

The results are presented of a program to establish the groundwork for the future design of a 20 kilowatt solar array simulator. The immediate goal of the program was to provide the technological basis for the design of high power, high frequency response simulators, and to serve as a review and amplification of the basic problems that can be encountered in such designs. The tradeoff studies involved in the program are described and the problems, techniques, and conclusions revealed in the studies are presented.
D.L.G.

N71-26084* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HEAT ACTIVATED CELL WITH ALKALI ANODE AND ALKALI SALT ELECTROLYTE Patent
Jacob Greenberg and Thomas E. Seitz, inventors (to NASA) Issued 12 Jan. 1971 3 p Filed 30 Dec. 1968 Cl. 136-6; Int. Cl. H01m35/02
(NASA-Case-LEW-11358; US-Patent-3,554,806; US-Patent-Appl-SN-787908) Avail: US Patent Office CSCL 10C

A heat activated cell having an anode made of one or more alkali metals and a cathode made of an oxidizing material which will react with the anode to form a stable salt is described. The anode and cathode are separated by an alkali salt electrolyte deposited in a thin layer on a divider made of a porous electrically conductive material. The salt is heated to a temperature sufficiently below its melting temperature that it does not disintegrate.
Official Gazette of the U.S. Patent Office

N71-26226*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROCEEDINGS OF THE THIRD ANNUAL CONFERENCE ON EFFECTS OF LITHIUM DOPING ON SILICON SOLAR CELLS
P. A. Berman and J. Weingart, eds. 1 Apr. 1971 134 p refs Conf. held at Pasadena, Calif., 27–28 Apr. 1970
(Contract NAS7-100)
(NASA-CR-118627; JPL-TM-33-467) Avail: NTIS CSCL 10A

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N71-26227*# Globe-Union, Inc., El Monte, Calif. Centralab Semiconductor Div.

LITHIUM-DIFFUSED SILICON SOLAR CELLS Progress Report

P. A. Iles *In* JPL Proc. of the 3d Ann. Conf. on Effects of Lithium Doping on Silicon Solar Cells 1 Apr. 1971 p 3–10 (See N71-26226 14-03)

(Contract JPL-952546)

Avail: NTIS CSCL 10A

Progress made in performance and understanding of lithium cells is outlined, and the possibility of their use in space missions is examined. Boron diffusion methods using BCl3 and BBr3 and cell properties after diffusion are described. Lithium diffusion methods concentrated on single drive-in cycles using lower diffusion temperatures and longer times. Lithium cell output increased due to improved processing methods, the use of CG silicon, and a decrease in specified lithium concentration. N.E.N.

N71-26228*# Heliotek, Sylmar, Calif.

DEVELOPMENT IMPROVED PROCESSES AND EFFICIENCIES FOR LITHIUM-DOPED SOLAR CELLS

R. Payne and E. L. Ralph *In* JPL Proc. of the 3d Ann. Conf. on Effects of Lithium Doping on Silicon Solar Cells 1 Apr. 1971 p 11–18 (See N71-26226 14-03)

(Contract JPL-952547)

Avail: NTIS CSCL 10A

Experimental work aimed at the improvement of cell processes and efficiencies, and the fabrication and statistical analyses of quantity of various lithium solar cell types are summarized. The essential processes used in the fabrication of Li-doped solar cells include boron diffusion using a BCl3 source, lithium diffusion, redistribution of the lithium, evaporation of the TiAg contacts, and SiO antireflection coating. Some of these procedures were altered for different groups of cells: BBr3 was utilized as the boron source, both lithium evaporation and lithium paint-on techniques were used, and for particular lithium diffusions the lithium redistribution was eliminated. Author

N71-26229*# TRW Systems Group, Redondo Beach, Calif.

USE OF LITHIUM TO RADIATION-HARDEN SOLAR CELLS

J. R. Carter, Jr. and R. G. Downing *In* JPL Proc of the 3d Ann. Conf. on Effects of Lithium Doping on Silicon Solar Cells 1 Apr. 1971 p 19–40 refs (See N71-26226 14-03)

Avail: NTIS CSCL 10A

Hall coefficient measurements were utilized to study the changes that occur in Li-doped silicon during irradiation and after recovery. It was possible to identify the major defects produced during the irradiation and to monitor the changes which occur after irradiation. Capacitance measurements on Li-diffused solar cells allowed similar studies of the changes in donor concentration which confirm and support the Hall measurements. The evaluation program consisted of time-dependent measurements of Li-doped float-zone silicon solar cells irradiated with 1-MeV electrons for measurements during storage at room temperature. The evaluation of Li-doped quartz-crucible solar cells was by storage at storage temperature of 60, 80, and 100 C after irradiation. Lithium concentrations near the junction were determined by capacitance and related to observed behavior. Author

N71-26230*# Radio Corp. of America, Princeton, N.J. Astro-Electronics Div.

STUDY TO DETERMINE AND IMPROVE DESIGN FOR LITHIUM-DOPED SOLAR CELLS

G. J. Brucker, T. J. Faith, and J. P. Corra *In* JPL Proc. of the 3d Ann. Conf. on Effects of Lithium Doping on Silicon Solar Cells 1 Apr. 1971 p 41–58 (See N71-26226 14-03)

Avail: NTIS CSCL 10A

An experimental investigation of the physical properties of lithium containing p-on-n solar cells and bulk silicon samples, and of the processes which occur in these devices and samples before and after irradiation is reported. Experiments on bulk samples include Hall and resistivity measurements taken as a function of bombardment temperature, resistivity, fluence, oxygen concentration, and annealing time at temperatures from 300 to 373 K. Diffusion length measurements on solar cells were made as a function of the same parameters as for bulk samples. In addition, capacitance, I-V, and diffusion constant measurements were made on selected cells. Stability studies employing I-V measurements under 140 mW of tungsten light were conducted on solar cells which were irradiated and observed for long periods under storage at room temperature. Author

N71-26231*# Naval Research Lab., Washington, D.C.

HALL EFFECT STUDIES OF IRRADIATED Si(Li) AT CRYOGENIC TEMPERATURES

John Stannard *In* JPL Proc. of the 3d Ann. Conf. on Effects of Lithium Doping on Silicon Solar Cells 1 Apr. 1971 p 59–66 refs (See N71-26226 14-03)

Avail: NTIS CSCL 10A

The events that occur during electron damage and room temperature recovery in float-zoned silicon doped with lithium are described. Cryogenic Hall measurements allow the overall concentration of radiation-induced deep acceptors to be monitored along with the overall concentration of shallow donors. In addition, the activation energy and concentration of levels lying between 0.06 and 0.20 eV below the conduction band may be separately measured provided that the spectrum is not too complex. Author

N71-26232*# Gulf General Atomic, San Diego, Calif.

INTRODUCTION AND ANNEALING OF DAMAGE IN LITHIUM-DIFFUSED SILICON

J. A. Naber, B. C. Passenheim, and H. Horiye *In* JPL Proc. of the 3d Ann. Conf. on Effects of Lithium Doping on Silicon Solar Cells 1 Apr. 1971 p 67–72 refs (See N71-26226 14-03)

Avail: NTIS CSCL 10A

The effects of space radiation on the electrical properties of Li-diffused bulk silicon are investigated. Neutron activation analysis, minority carrier lifetime, electrical conductivity, Hall effect, electron spin resonance, and infrared absorption are used to monitor electron- and neutron-produced damage. It was found that the greater the lithium concentration, the greater the introduction rate of recombination centers, and the faster the annealing rate and the more complete the annealing. Author

N71-26233*# Northrop Corporate Labs., Hawthorne, Calif.

RADIATION EFFECTS IN BULK LITHIUM- AND ALUMINUM-DOPED SILICON

O. L. Curtis, Jr. and R. F. Bass *In* JPL Proc. of the 3d Ann. Conf. on Effects of Lithium Doping on Silicon Solar Cells 1 Apr. 1971 p 73–80 refs (See N71-26226 14-03)
Avail: NTIS CSCL 10A

The effects of Co-60 gamma radiation on the electrical properties of bulk silicon was investigated. Minority carrier lifetimes were determined by the photoconductivity decay technique following carrier injection by a 50-ns pulse of 150 kV X-rays. The lifetimes were found to be dependent on the isochronal annealing temperature. Unirradiated aluminum-doped crucible grown samples with short lifetimes and excessive trapping were annealed for 8 hours at 460 C, and an in resistivity was noted. N.E.N.

N71-26234*# Naval Research Lab., Washington, D.C.
REAL-TIME IRRADIATION OF LITHIUM-DOPED SOLAR CELLS
R. L. Statler *In* JPL Proc. of the 3d Ann. Conf. on Effects of Lithium Doping on Silicon Solar Cells 1 Apr. 1971 p 81–84 refs (See N71-26226 14-03)
Avail: NTIS CSCL 10A

Radiation damage in Li-doped p-n cells and in 10-ohm-cm n-p cells was evaluated using Co-60 gamma radiation. The output power of the Li-doped cells was not as great as that of the conventional n-p cells for temperatures of 30 and 60 C. All cells irradiated at the higher temperature showed more damage than those irradiated at the lower temperature. N.E.N.

N71-26235*# Kentucky Univ., Lexington.
OBSERVATION OF STRUCTURAL DAMAGE IN LITHIUM-DOPED SILICON SOLAR CELLS PRODUCED BY NEUTRON IRRADIATION
G. A. Sargent and S. Ghosh *In* JPL Proc. of the 3d Ann. Conf. on Effects of Lithium Doping on Silicon Solar Cells 1 Apr. 1971 p 85–92 refs (See N71-26226 14-03)
Avail: NTIS CSCL 10A

Doped and undoped cells were irradiated in order to investigate the form of structural damage produced in Li-doped p-n silicon cells by the neutron irradiation. The cells were thinned by chemical polishing, etched, and observed by surface replication and thin film transmission electron microscopy. In the unirradiated and Li-doped samples, there was some evidence that lithium was present in the form of finely dispersed precipitates. Damage to the cells produced by irradiation could be observed as etch pits in the form of shallow craters at the surface and as circular regions within the bulk of the sample by surface replication and transmission electron-microscopy. The apparent size and distribution of the observed defects were in accord with the theories of defect clusters previously proposed. The density of defects produced by irradiation increased with increasing irradiation dose; however, the size of the defects seemed to decrease with the presence of lithium. Author

N71-26237*# Brown Univ., Providence, R.I. Div. of Engineering.
EFFECTS OF SUB-THRESHOLD HIGH-ENERGY ELECTRONS ON THE PROPERTIES OF SILICON PHOTOVOLTAIC CELLS
E. E. Crisman and J. J. Loferski *In* JPL Proc. of the 3d Ann. Conf. on Effects of Lithium Doping on Silicon Solar Cells 1 Apr. 1971 p 101–106 refs (See N71-26226 14-03)
Avail: NTIS CSCL 10A

The possible effects on the electronic properties of Li-doped Si photovoltaic cells of irradiation by electrons whose energy is below that required to displace Si atoms are considered. Experimental procedures for observing the surface and bulk effects are described. The results of the experiments designed to determine whether bulk effects are associated with Li atom displacements are presented. It is concluded that Li atom displacement effects were observed and that the displacement leads to a reduction in bulk lifetime. It is suggested that the electron irradiation dislodges Li from complexes in which Li had neutralized a defect existing in Si as a natural result of events involved in the fabrication of Li-doped solar cells. Author

N71-26239*# Utah Univ., Salt Lake City.
KINETICS IN SOLAR CELL DAMAGE
A. Sosin *In* JPL Proc. of the 3d Ann. Conf. on Effects of Lithium Doping on Silicon Solar Cells 1 Apr. 1971 p 113–114 (See N71-26226 14-03)
Avail: NTIS CSCL 10C

Efforts toward developing a reaction rate model for the electrical behavior of irradiated Li-doped solar cells are described, and earlier work is reviewed. The central problem in the kinetics of solar cells is considered to lie in the need for experimental data. Experimental parameters and properties to be measured are suggested. N.E.N.

N71-26240*# Philco-Ford Corp., Palto Alto, Calif. Development Labs.
DESCRIPTION OF LOW-RATE SPECTRAL ELECTRON IRRADIATION PROGRAM
D. L. Reynard *In* JPL Proc. of the 3d Ann. Conf. on Effects of Lithium Doping on Silicon Solar Cells 1 Apr. 1971 p 115–124 refs (See N71-26226 14-03)
Avail: NTIS CSCL 10A

The development of equipment to study Sr-90 electron irradiation effects in Li-diffused silicon is reported. The Sr-90 source was selected for simulation of the trapped electron environment because of the smoothed composite spectrum of Sr-90 and its daughter Y-90. The cylindrical chamber, solar simulator, vacuum pumping system, cell mounting, and radiation facility are described. N.E.N.

N71-26241*# Lockheed Georgia Co., Marietta. Research Lab.
A REAL-TIME STUDY OF THE EFFECT OF ELECTRON RADIATION ON LITHIUM p-n SOLAR CELLS
R. R. Dayton *In* JPL Proc. of the 3d Ann. Conf. on Effects of Lithium Doping on Silicon Solar Cells 1 Apr. 1971 p 125–128 (See N71-26226 14-03)
Avail: NTIS CSCL 10A

The test facilities for studying irradiation effects on the solar cells at –50, 30, 60, and 80 C are described. The environmental chamber is made of stainless steel and may be divided into three sections. The main body of the chamber contains the test solar cells and a large fused silica window through which the light will be projected. To the right of the main body is the source handling and storage area and on the left is the vacuum pumping station. Data is collected in-situ by an automatic data collection system. The potential drop across a series of calibrated resistors as measured by a digital voltmeter is used to derive the I-V characteristic. The maximum power and maximum power point are computer-calculated. The beta source to solar cell geometry required to deliver the desired flux was determined by comparative analysis. The beta spectrum is shown. Author

N71-26289*# Pennsylvania Univ., Philadelphia. Electrochemistry Lab.
STUDIES IN FUNDAMENTAL CHEMISTRY OF FUEL CELL REACTIONS Quarterly Report, 1 Jul.–30 Sep. 1970
John O. Bockris 30 Sep. 1970 35 p refs
(Grant NGR-39-010-002)
(NASA-CR-118652; QR-7) Avail: NTIS CSCL 10A

Continuing research is reported aimed at a theoretical calculation for the rate of the oxygen dissolution reaction and a study of the properties of the metal electrode on which the rate of reaction depends most. The results of three projects directed

towards this goal are presented and include: (1) a crude computation of the activation energy for the oxygen dissolution reaction, (2) an absorption study in zinc electrodes for silver batteries using a radiotracer technique, and (3) a study on the reversibility of organic reactions by testing the efficiency of the rhodizonic acid - graphite paste electrode. D.L.G.

N71-26389*# Hughes Aircraft Co., El Segundo, Calif. Space Systems Div.
SOLAR CELL RADIATION DAMAGE EXPERIMENT Quarterly Report, 28 Dec. 1970 - 27 Mar. 1971
19 Apr. 1971 33 p
(Contract NAS5-11677)
(NASA-CR-118660; Rept-71(41)-4140/B7511; QR-7) Avail: NTIS CSCL 10A

The design and testing are described for the solar cell radiation damage experiment, scheduled for launch on the ATS-F spacecraft, which is to provide high accuracy data for technical evaluation of the effects of the space radiation environments on solar cells. The flight experiment consists of a small solar panel mounted externally on the environmental measurements experiment package, which is to interface with the spacecraft. The solar panel has a total of 80 solar cells, representing 16 solar cell configurations. Thirteen solar cell configurations are to be mounted to the rigid panel portion of the solar panel (infinite back-shielding), and three configurations are to be mounted to the flexible panel (2 mils of a Kapton-fiberglass substrate). In addition, the experiment has two signal processor units required for data sampling and telemetry. The solar cell experiment is to be activated at programmed intervals to obtain voltage-current data for each individual solar cell and to obtain temperature and calibration data. The ground test program includes evaluation of the effects on solar cells and solar cell assemblies under an environment which simulates both synchronous electrons and low energy protons. Author

N71-26840*# Naval Ammunition Depot, Crane, Ind.
SPACE CELL TEST PROGRAM Progress Report
15 Apr. 1971 78 p
(NASA Order S-23404-G)
(NASA-CR-118661) Avail: NTIS CSCL 10A

Separator, open-circuit, overcharge, plate, and charge stand tests are described for nickel-cadmium, silver-zinc, silver-cadmium, and zinc-oxygen cells to be used in IMP, synchronous, and earth satellites. J.M.

N71-26726* Hughes Aircraft Co., Los Angeles, Calif.
SOLAR PANEL FABRICATION Patent
Preston S. Du Pont, inventor (to NASA) Issued 23 Feb. 1971 5 p Filed 17 May 1967 Cl. 156-212; Int. Cl. B29c17/04 Sponsored by NASA
(NASA-Case-XNP-03413; US-Patent-3,565,719; US-Patent-Appl-SN-640456) Avail: US Patent Office CSCL 10A

Methods and apparatus are discussed for precisely fabricating solar cells on a substrate. The solar cells are mounted face down in a flexible mat. The mat is then bent to the configuration the cells will have in final assembled form, and then a substrate is bonded to the backs of all the cells at one time. Official Gazette of the U.S. Patent Office

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N71-25674# Naval Air Development Center, Johnsville, Pa. Aerospace Medical Research Dept.
A REVIEW OF EXPERIMENTAL DATA ON THE CARDIOVASCULAR RESPONSE TO ACCELERATION
Glen L. Goodhart 31 Dec. 1970 24 p refs
(AD-719902; NADC-MR-7004; NAVMED-MF12.524.008-7001-14) Avail: NTIS CSCL 6/19

Controlled physiological responses to gravitational stress is a major concern in cardiovascular simulation. Information pertaining to the physiological effects of positive acceleration on the cardiovascular system has been gathered from the literature and is presented in light of requirements for cardiovascular simulation. Both generalized and long term responses to G stress are considered as well as the transient G studies that were available. Author (GRA)

N71-25715*# Biospherics, Inc., Rockville, Md.
IRIS BIOLOGICAL EXPERIMENTS Annual Report, Apr. 1970 - Apr. 1971
15 Apr. 1971 59 p refs
(Contract NAS5-11294)
(NASA-CR-118629) Avail: NTIS CSCL 06C

The types of data to be obtained from the Mariner Mars '71 Infrared Interferometer Spectrometer (IRIS) experiment have been examined for the inferential information they may yield regarding the possibility of Martian surface biota. The IRIS will analyze the types and concentrations of trace gas constituents in the Martian atmosphere and, in wavelength regions where no gases absorb, the IRIS will also obtain reflectance data from the surface of Mars. Regarding surface reflectance, our results indicate that neither biological nor organic material exhibit characteristic reflectance signatures in the range of the IRIS other than a black body response. These findings make it unlikely that definitive biological inferences can be drawn from the IRIS reflectance data. However, biological materials will quench the SiO_2 reststrahlen which will readily appear in one IRIS window. Thus, the possibility of inferring biological or organic material by quench of SiO_2 reststrahlen, while remote, does exist. Author

N71-25716*# Techtran Corp., Glen Burnie, Md.
OBSERVATIONS OF THE CUPULA IN THE AMPULLAE OF THE SEMICIRCULAR CANALS OF THE LABYRINTH OF A LIVING PIKE [UEBER DIE BEOBACHTUNG DER CUPULA IN DEN BOGENGANGSAMPULLEN DES LABYRINTHS DES LEBENDEN HECHTS]
W. Steinhausen Washington NASA May 1971 19 p refs Transl. into ENGLISH from Arch. Gesa. Physiol. (Berlin), v. 232, 1933 p 500-512
(Contract NASw-2037)
(NASA-TT-F-13665) Avail: NTIS CSCL 06C

The cupula of the left horizontal ampula and semicircular canal in a living pike was stained and its behaviour was observed during electrical and mechanical stimulation. Electrical stimulation failed to produce any movement of the cupula, and a deviation of the eyes to the right is produced only when the current flow is from the utrical toward the semicircular canal. Current flowing in the opposite direction produces no excitation. Author

N71-25746*+ Informatics Tisco, Inc., College Park, Md.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 87
Washington NASA Mar. 1971 115 p refs
(NASA-SP-7011(87)) Avail: NTIS CSCL 06B

Subject coverage concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included.

Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Each entry consists of a standard citation accompanied by its abstract. Author

N71-25766# Institute of Occupational Health, Helsinki (Finland). Dept. of Physiology.
THE CONTROL OF HUMAN THERMOREGULATORY HEAT PRODUCTION, PART 2 Final Scientific Report, 1 Apr. 1966 - 30 Nov. 1970
Pekka Piironen and Kauko Takalo 30 Nov. 1970 33 p refs
(Contract AF 61(052)-936)
(AD-720831; AFOSR-71-0709TR-Pt-2) Avail: NTIS CSCL 6/16

Experiments were carried out for the study of control of thermoregulatory heat production, in which continuous records were made of the test subjects oxygen consumption and of the different body temperatures. The skin temperature of the subject was controlled during the experiment by conducting temperature-controlled water onto the skin, with the aid of a special exposure suit. In the first experimental series, the subjects skin temperature was kept constant during the test and the blood temperature was allowed to decrease slowly; the results obtained by this procedure were considered to correspond to control in steady state situations. In the second series, the skin temperature was varied in programmed manner. Analysis of the results revealed that both the steady-state and dynamic experiments can not be explained with the same quantitative control assumptions if the hypothalamic and skin temperatures are assumed to be the sole controlling variables. When as a third controlling variable the gradient of skin temperature was taken into consideration, the dynamic experiments could be considerably better accounted for. Author (GRA)

N71-25789*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RELATIONS AMONG LOUDNESS, LOUDNESS LEVEL, AND SOUND PRESSURE LEVEL
Walton L. Howes Washington May 1971 14 p refs
(NASA-TM-X-2298; E-6107) Avail: NTIS CSCL 20A

Formulas are given which relate the loudness, loudness level, and sound-pressure level of pure tones, hence of a band of steady noise that does not exceed the critical bandwidth. The formulas apply continuously over most of the acoustic regime and contain no undetermined coefficients. Author

N71-25867# Hawaii Univ., Honolulu. Dept. of Microbiology.
EFFECTS OF HYDROSTATIC PRESSURE ON PHOTOSYNTHESIS AND GROWTH OF UNICELLULAR MARINE ALGAE AND DIATOMS Annual Progress Report, 1 Apr. 1970 - 31 Mar. 1971
Leslie Ralph Berger 1 Apr. 1971 10 p refs
(Contract N00014-67-A-0387-0008)
(AD-720401; APR-2) Avail: NTIS CSCL 6/3

Light-dependent oxygen production and growth of algal cultures were measured at 25C at various light intensities and hydrostatic pressures. A device which maintains a desired concentration of dissolved oxygen during growth and oxygen evolution by photosynthetic organisms is described. The system uses a modified rate-measuring oxygen electrode system in conjunction with an oxygen concentration monitoring unit. Author (GRA)

N71-25937# University of Southern Calif., Los Angeles. Dept. of Mathematics.
HIERARCHIES OF CONTROL PROCESSES AND THE EVOLUTION OF CONSCIOUSNESS
Richard Bellman Apr. 1971 6 p refs Presented at 6th Berkeley Symp. in Probability and Statistics, Berkeley, Calif., 9 Apr. 1971
(Grant GM-16197-03)
(TR-71-17) Avail: Issuing Activity

Some ideas in the mathematical theory of control processes are applied to biological phenomena such as instinct, learning, curiosity, adaptation and, finally, consciousness. The language and methodology of the theory of dynamic programming are employed. Detailed accounts of the mathematical ideas are presented. Author

N71-25953# Institute of Occupational Health, Helsinki (Finland).
ASSESSMENT OF REGIONAL HEAT LOSSES FOR VERIFICATION OF MATHEMATICAL ANALOGUES OF THE HUMAN THERMAL SYSTEM, PART 1 Final Scientific Report 1 Apr. 1966 - 30 Apr. 1970
Pekka Piironen and Kauko Takalo 30 Nov. 1970 75 p refs
(Contract AF 61(052)-936)
(AD-720830; AFOSR-TR-71-0708) Avail: NTIS CSCL 6/16

Elaboration of mathematical analogues for the human thermal system implies that various simplified, steady-state and dynamic, heat transfer situations are experimentally mastered with full repeatability. In a stable thermal environment, the high thermal time constants of peripheral tissues and individual structural and functional differences impede the achievement of comparable and reproducible stationary and dynamic heat transfer situations in the organism at rest and during exercise. However, by active governing of the skin temperature, the establishment of steady states can be greatly accelerated and the development of desired dynamic states is under control. The aim of the study was to develop a set of equipment for regional controlling of skin temperatures and equipment for measuring the external heat exchange of the different parts of the body. The methods and equipment have been applied in testing a simple mathematical model which was worked out to describe the passive part of human heat transfer system. Author (GRA)

N71-25957# School of Aerospace Medicine, Brooks AFB, Tex.
EFFECTS OF MONOAMINE OXIDASE INHIBITORS AND RESERPINE ON BRAIN AMINES IN ALTITUDE EXPOSED RATS Interim Report, Nov. 1969 - Jan. 1970
James H. Merritt and Miguel A. Medina Feb. 1971 11 p refs
(AD-720808; SAM-TR-71-3) Avail: NTIS CSCL 6/19

Groups of rats were injected with either pargyline, Parnate, Catron, or reserpine (75 mg./kg., 5 mg./kg., 5 mg./kg., and 5 mg./kg. respectively) and taken to a simulated altitude of 18,500 ft. The expected rise in the brain monoamine (norepinephrine and serotonin) levels after administration of monoamine oxidase inhibitors and the decrease of norepinephrine by reserpine were attenuated by altitude exposure. In another experiment, 100 percent oxygen was substituted for ambient air. In this case, the attenuation of monoamine elevations by the inhibitors was reversed. However, the added oxygen did not reverse the attenuation of the norepinephrine decrease by reserpine. Author (GRA)

N71-25958# Philco-Ford Corp., Newport Beach, Calif. Aeronutronic Div.
INVESTIGATION OF ANIMAL SENSOR AND SENSON INFORMATION PROCESSING MECHANISMS FOR APPLICATION TO TARGET ACQUISITION AND TRACKING Final Report, 15 Jan. 1970 - 15 Jan. 1971
Robert E. Kay Feb. 1971 62 p refs
(Contract N00019-70-C-0150)
(AD-720412; U-4908) Avail: NTIS CSCL 6/2

The investigation was concerned primarily with the sensory modes used by flies, bees, and moths to acquire and track targets. Analyses of the findings suggested methodologies for the construction of a system to detect and possibly identify trace amounts of airborne chemicals and to a novel light sensing device which appears to have potential as an inexpensive solar cell. The olfactory instrument is composed of an array of units each one of which has its own view of the odor environment. The individual

units may have a hair-like configuration and they can be electrically biased. Desorption of odor is readily accomplished by exposure to clean air. The effect of odor on the electrical bias is read from each individual unit in the array and the readout is fed to a logic system which constructs a final composite waveform to identify the odor constituent. A partially successful unit consisting of a filament coated with a liquid potassium soap and stretched between platinum electrodes is described, and the design for an organic semiconductor odor is suggested. The solar cell is composed of a sandwich constructed of a SnO2 coated glass plate, a dye film made of Methyl Violet 2B agar and water, and a glass plate coated with bright platinum. A conversion efficiency for 500 nm light of 0.48 percent was demonstrated and it is indicated that the efficiency may be 5 percent or more. Electrical characteristics of the photocell are presented and the nature of the apparatus is discussed. Author (GRA)

N71-28118# Royal Aircraft Establishment, Farnborough (England)
SOME EXPERIMENTS TO DETERMINE ACCELERATION LIMITS FOR PASSENGER COMFORT. APPENDIX B
D. I. Paddison *In its* Cabtrack Studies: Assessment of Autotaxi Urban Transport Systems Jan. 1969 p 25-26 refs (See N71-28116 14-34)
Copyright. Avail: NTIS

The importance of the acceleration limits imposed by consideration of passenger comfort is outlined. Although there is much information on the limits of acceleration for survival, little attention seems to have been paid to comfort. The major factors affecting comfort in lateral and longitudinal maneuvers are: (1) the peak acceleration level, (2) the rate of change of acceleration, and (3) the degree of body support. (Seat design and whether safety belts are used.) Author

N71-28167# Army Medical Research and Nutrition Lab., Denver, Colo.
SPECIES COMPARISON OF CARDIAC HYPERTROPHY IN ANIMALS CHRONICALLY EXPOSED TO HIGH ALTITUDE
Thomas J. Bucci, Winfred D. Dean, George W. Bishop, Laszlo A. Frics, James A. Vogel et al Jan. 1971 38 p refs
(AD-720596; USAMRNL-326) Avail: NTIS CSCL 6/19

Heart size and possible causative factors were compared in the dog, rat and rabbit after five months exposure to sea level, 5,380, 11,140 and 14,110 feet. From 5,380 to 14,110 feet, the ratio of right ventricle to body weight (RV/BW) increased in the rat by 50%, the rabbit by 59% and the dog by 6%. From sea level to 14,110 feet, the ratio of right ventricle to total ventricle (RV/T) increased progressively -- in the rat by 38%, the rabbit by 39% and the dog by 6%. At sea level the dog has a relatively larger right ventricle than either the rat or rabbit, with an RV/T ratio of .26 vs .21 and .22. Similarly, the dog has a RV/BW (g/kg) ratio of 1.66 vs .64 and .35, for the rat and rabbit respectively. Comparing sea level to 14,110 ft., packed cell volume (PCV) increased 16%, 30% and 36% respectively in the dog, rat and rabbit. Mean pulmonary artery pressure increased by 81% in the dog and 87% in the rabbit. These results suggest that hypoxic cardiac hypertrophy is not a simple function of increased PCV and pulmonary artery pressure since these latter changes occurred in all species while hypertrophy did not. The relative size of the heart and its possible reserve potential appear to be important factors. Electron microscopic examination of the myocardium showed markedly enlarged, vesicular pale mitochondria in all three species. The mitochondrial cristae were reduced in number and irregularly arranged. Many of the capillaries had edematous endothelium. The significance of these ultrastructural changes is now known. Author (GRA)

N71-28168# RAND Corp., Santa Monica, Calif.
INDUCED FIELDS AND HEATING WITHIN A CRANIAL STRUCTURE IRRADIATED BY AN ELECTROMAGNETIC PLANE WAVE
A. R. Shapiro, F. R. Lutomirski, and H. T. Yura Nov. 1970 33 p refs
(AD-720589; P-4458-1) Avail: NTIS CSCL 6/16

The induced fields and the static heating patterns within a multi-layered spherical model that approximates the primate cranial structure irradiated by plane waves in the microwave spectrum are calculated. The relation of the model to the biological structure and the sensitivity of the results to the uncertainties in the dimensions and electrical properties of biological material are investigated. A method of solution for both the scattered and interior fields for a sphere with an arbitrary number of electrically different concentric layers is developed in a form readily amenable to machine computation. It is shown that the semi-infinite slab model is inappropriate for calculating the microwave radiation dosage to the human head and similar structures. Author (GRA)

N71-28172# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
CREW EXPOSURE TO VIBRATION IN THE F-4C AIRCRAFT DURING LOW ALTITUDE, HIGH SPEED FLIGHT Final Report
Jerry D. Speakman, Hubert F. Bonfili, Harold K. Hille, and John N. Cole Jan. 1971 473 p refs
(AD-720271; AMRL-TR-70-99) Avail: NTIS HC $6.00/MF $0.95 CSCL 6/19

Measurements were made of the total vibration environment that the crew member is exposed to in the aft compartment of a F-4C aircraft during low-altitude, high-speed flight. Data were obtained of the longitudinal, lateral and vertical linear accelerations and the roll, pitch and yaw angular accelerations in the aft compartment and of the lateral and vertical linear accelerations at the aircraft center of gravity. The flights were performed in the contour following mode at various speeds at an altitude of 100-1000 feet over several different types of terrain. Data analysis included peak counting, probability density and distribution, auto-power spectral density and tests for stationarity, randomness and normality. The individual degree-of-freedom results are presented in graphical and tabular form and in general indicate that the crew station vibration environment produced by the combination of gust response and maneuvering: (1) is stationary for up to 400 seconds; (2) does not satisfy the chi-square goodness-of-fit test for Gaussian distribution; (3) exhibits a spectral content that is determined by certain aircraft design characteristics; (4) has for various flight conditions a power spectral density that can vary in overall level by a factor of 30; (5) cannot be adequately simulated for human tolerance type studies by considering the vertical axis accelerations only. Author (GRA)

N71-28204*# Miami Univ., Coral Gables, Fla. Center for Theoretical Studies.
DOES THE BRAIN HAVE SYMMETRY?
Gerhard Meck Feb. 1971 51 p refs
(Grant NGL-10-007-010)
(NASA-CR-118517; CTS-B-71-2) Avail: NTIS CSCL 06P

A model designed to describe the first steps of information processing along the visual pathways of the brain is proposed. It was suggested that neurons carry out a harmonic analysis over the groups of symmetry transformations. It was shown that the brain can compute the compensating change of neuronal amplification factors for symmetry transformations induced by continuous rotation of the eyeball. The compensation is carried out by a control circuit. It was also shown how the brain can recognize exact and partial symmetries of patterns, and why diffuse illumination of the retina will lead to little or no response of most neurons, while sharp boundaries of light-dark will evoke enhanced activity. How information from different receptive fields should be added is also discussed. E.H.W.

N71-26245 Nebraska Univ., Lincoln.
A STUDY OF POLARIZATION AND ENERGY CONVERSION IN BIOLOGICAL FUEL CELLS
James Lauris Hendrix (Ph.D. Thesis) 1969 123 p
Avail: Univ. Microfilms Order No. 70-12266

Yeast cultures, systems of lactate fermentations, and biological systems frequently found on a farm were studied. A fuel cell composed of platinum-blacked nickel screen electrodes and a cation exchange membrane as the electrolyte was used. Dilute ethanol and lactic acid solutions were used to study the parameters of the fuel cell. Fuel concentration, fuel flow rate, and the effect of the platinum-black catalyst were investigated. After interpretation of a number of the fuel cell parameters, six biological systems were studied and compared to each other and with the dilute ethanol and lactic acid systems. The biological systems studied were a Saccharomyces carlsbergensis fermentation, a contaminated S. carlsbergensis fermentation (acetic acid formed), Lactobacillus delbrueckii fermentations, sauerkraut juice, silage, and rumen liquor. It was found that of the systems studied, the lactic acid produced by L. delbrueckii was the best biological fuel. Dissert. Abstr.

N71-26261# Santa Rita Technology, Inc., Santa Clara, Calif.
EXPERIMENTS IN AUDITORY PERCEPTION WITH AN ANALOG MODEL FOR THE EAR Final Report, 10 Apr. 1965 10 Apr. 1970
John L. Stewart Wright-Patterson AFB, Ohio AMRL Oct. 1970 147 p refs
(Contract F33615-68-C-1361)
(AD-720246; AMRL-TR-70-81) Avail: NTIS CSCL 6/16

The model representation for portions of peripheral, ascending and central mechanisms in auditory processing was extended so as to better match human behavior and structure. The improved model was needed to implement the fundamental purpose of the research, namely, developing better ways for achieving speech bandwidth compression. Of particular interest and importance were observations of the fluctuations in analog ear patterns at glottal rates. Earlier techniques with analog ears and spectrum analyzers which smooth over these fluctuations are rather misleading as to the significance of extracted measures. Various algorithms for realizing bandwidth compression in which voice pitch may or may not be retained are developed. The question of bandwidth compression is closely related to word recognition and other problems of practical significance. The presentation is sufficiently generalized to include these other possible applications. Author (GRA)

N71-26302 Lovelace Foundation for Medical Education and Research, Albuquerque, N.Mex.
THE ACUTE EFFECTS OF AIR BLAST ON PULMONARY FUNCTION IN DOGS AND SHEEP Technical Progress Report
Edward G. Damon, John T. Yelverton, Ulrich C. Luft, Kabby Mitchell, Jr., and Robert K. Jones Mar. 1970 43 p refs
(Contract DA-49-146-XZ-372)
(AD-709972; DASA-2461) Avail: NTIS CSCL 6/21

The results of studies on the relationship between air blast injury and impairment of pulmonary function in dogs and sheep are presented. The impairment of pulmonary function was measured in terms of alterations in the venous-arterial shunt, ineffective alveolar ventilation, and blood gas tensions. Author

N71-26380*# Biospherics, Inc., Rockville, Md.
AUTOMATED MICROBIAL METABOLISM LABORATORY Final Report
Donald G. Shaheen, Edward Rich, Jr., and William A. Lindgren 28 Apr. 1971 215 p refs
(Contract NASw-1931)
(NASA-CR-118659) Avail: NTIS CSCL 06M

Problems associated with life detection assays to be incorporated into an automated breadboard instrument are discussed. Significant advances were made in the labeled carbon dioxide fixation-dark release and radioactive carbon and sulfur uptake experiments. In all cases, levels of the nonbiological signals were reduced and the overall precision of the experiments was increased by the incorporation of newly devised techniques into the assays. This greatly enhanced the sensitivity and reliability of these exobiology experiments. Measurement of the kinetics of biological responses as well as the study of experimental variables increased the store of knowledge and experience relative to each of the assays. The instrument components for the various experiments were designed, fabricated, integrated, and tested to demonstrate system feasibility. An integrated biology experiment was conducted using the instrument to perform the labeled release, labeled carbon and sulfur uptake, ATP production, and phosphate uptake experiments. Author

N71-26385*# School of Aerospace Medicine, Brooks AFB, Tex. Environmental Sciences Div.
FLUID BALANCE IN ARTIFICIAL ENVIRONMENTS. 2: INFLUENCE OF PHYSIOLOGICAL CHANGES UPON RATES OF SKIN INSENSIBLE WATER LOSS
William M. Carleton and B. E. Welch Apr. 1971 46 p refs
(NASA Order T-74393-G)
(NASA-CR-115024) Avail: NTIS CSCL 06P

The significant and reproducible effects of ambient temperature (T sub a), water vapor pressure (P sub H2O), total barometric pressure (P sub B), wind speed (V), and atmospheric gas composition (G.C.) upon the rate of water loss from human skin under various physiological and constant environmental conditions were investigated. With careful control of the physical parameters of the environment, i.e., T sub a, P sub H2O, P sub B, V, and G.C., it was possible to vary the physiological state of the experimental subjects and document any significant changes in rates of skin insensible water loss that might be related to these physiological changes. Author

N71-26399*# Connecticut Univ., Storrs. Dept. of Animal Diseases.
BIOLOGICAL ACTIVITY OF LUNAR SOIL Final Report, 7 Jan.–31 Oct. 1970
Alan J. Kenyon 1970 36 p refs
(Contract NAS9-8918)
(NASA-CR-118671) Avail: NTIS CSCL 06M

Clinical pathology procedures for the detection of diseases in germfree mice maintained within Class 3 isolators were developed and tested. Design and construction of an aerosolization chamber for the study of titanium-containing dusts has been completed. Standard curves have been obtained spectrophotometrically with TiO2. Titanium has been detected in the lymphoid structures of hamsters, mice, and rats. In a prototype chamber, rats were treated with aerosolized TiO2 and distribution of titanium established. Author

N71-26432 Texas Technological Univ., Lubbock.
PERFORMANCE AND RECOVERY UNDER PROLONGED VIBRATION
Tarek M. Khalil (Ph.D. Thesis) 1969 174 p
Avail: Univ. Microfilms Order No. 70-12312

The performance and recovery characteristics of men when subjected to relatively long periods of whole body, vertical vibration is investigated. Seven male subjects participated in the experiment. They were to perform according to four work/rest schedules, under normal and vibratory environments, with performance measured during nine periods throughout the experiment. The task adopted for this investigation was one of vertical compensatory tracking. The controlled element, seen as a beam of light on a cathode ray tube, was driven upward and downward by a program prerecorded on a magnetic tape. The subjects' task was to keep the controlled element aligned with a horizontal line displayed in the center of the

CRT, by use of a hand controller. This task was performed under normal environment as well as relatively long period vibrational environments. The vibrational environment of interest was that of a vertical sinusoidal vibration with a frequency of 5 cps and an amplitude of 0.08 inches. Dissert. Abstr.

N71-26456# Joint Publications Research Service, Washington, D.C.
THE SOIL SCIENCES AND THE PRODUCTIVITY OF THE BIOSPHERE
V. A. Kovda *In its* Vestn. of the USSR Acad. of Sci., Vol. 40, No. 6, 1970 31 Aug. 1970 p 103–112 ref (See N71-26452 14-30)
Avail: NTIS

The history of the development of soil science is projected. It is stipulated that photosynthesis on dry land is the main source of energy drawn into soil formation, and that the driving force of that process is the combination of biological and geological circulation of substances which brought the formation of different types of soils and landscapes. The accumulation of a stable complex of organic substances with its enormous sources of latent energy is a general planetary function of the soil cover in the biosphere. Grassy landscapes store energy in their humus shells exceeding by 20 to 30 times the energy in the plant biological mass. G.G.

N71-26587# Forsvarets Forskningsanstalt, Stockholm (Sweden). Avdelning 2.
REPORT ON A CONFERENCE ON PICTURE PROCESSING [RAPPORT FRAN KONFERENS OM BILDBEHANDLING]
Torleiv Orhaug Nov. 1969 7 p In SWEDISH Conf. held at Munich, 18–22 Aug. 1969
(FOA-2-C-2354-72) Avail: NTIS

Image evaluation studies comprise: (1) real-time interpretation, image intensifiers and television systems; (2) systems approach to image interpretation and sensor design; (3) image parameters; (4) search and detection; (5) the human visual system; (6) problems arising in the use of optical instruments; and (7) theoretical studies, simulation and pattern recognition. G.G.

N71-26638# Defense Documentation Center, Alexandria, Va.
FUNGUSPROOFING: INDUSTRIAL PROCESSING SERIES, VOLUME 1 Report Bibliography, Dec. 1943–Jul. 1970
Feb. 1971 73 p refs
(AD-720202; DDC-TAS-70-83-1) Avail: NTIS CSCL 6/6

The bibliograph is the first volume of a two-volume set on Fungusproofing in a series of bibliographies on Industrial Processing. It includes 44 annotated references and covers the period from January 1953 to January 1971. Corporate author-monitoring agency, subject, title, personal author, and report number indexes are included. GRA

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N71-25623# Michigan Univ., Ann Arbor. Human Performance Center.
SPATIAL PROCESSING CHARACTERISTICS IN THE PERCEPTION OF BRIEF VISUAL ARRAYS
Gerald T. Gardner (Ph.D. Thesis) Aug. 1970 91 p refs
(Contract AF 49(638)-1736; ARPA Order 461)
(AD-719797; Rept-08773-64-T; TR-23; AFOSR-TR-71-0438) Avail: NTIS CSCL 5/10

In the Estes and Taylor (1964, 1966) detection experiments, subjects (Ss) saw a brief array containing noise letters plus one of two critical letters, and attempted to determine which critical letter appeared; accuracy decreased as the number of noise letters increased. This was interpreted by Estes and Taylor and by Rumelhart (1970) as demonstrating a limitation of perceptual capacity. However, the experiments involved confoundings: stimulus arrays with more letters were either larger in visual angle or involved greater inter-letter crowding, both of which factors are known to decrease letter perceptibility. Experiments I and II in this study were patterned after the Estes and Taylor paradigm, but controlled both angular size and crowding factors by means of specially designed stimulus arrays. In both experiments, Ss performance decreased with increases in the number of letters, thus supporting limited-capacity models. Author (GRA)

N71-25652# California Univ., Berkeley. Center for Pure and Applied Mathematics.
SELF-ORGANIZING SYSTEMS Final Report, 1 Jan. 1961 – 14 Apr. 1969
Hans J. Bremermann Jan. 1971 9 p refs
(Contract Nonr-222(85))
(AD-719930) Avail: NTIS CSCL 6/4

The motivation and development of the contract is discussed and the most important results are summarized. They fall into four groups: Fundamental quantum-mechanical and thermodynamical limitations of data processing and the impact of these limitations upon the realization of algorithms, in particular algorithms of self-organization, artificial intelligence, tree search, etc.; The simulation of biological evolution and its connection with optimization and self-organization; The development of efficient non-local optimization algorithms and the application of these optimization algorithms to various practical problems: the solution of systems of non-linear algebraic equations in many variables, analysis of spectra with non-linear superposition, and non-linear systems identifications. Author (GRA)

N71-25792# RAND Corp., Santa Monica, Calif.
RAND SYMPOSIUM ON PILOT TRAINING AND THE PILOT CAREER Final Report
W. A. Stewart and E. S. Wainstein Dec. 1970 143 p Symp. held in Santa Monica, Calif., 23–27 Feb. 1970
(Contract F44620-67-C-0045)
(AD-720797; R-615-PR) Avail: NTIS CSCL 5/9

Contents: The pilot career; Career and education; The pilot skill--definition, measurement, and retention; Relevance of training to combat; Selection; Motivation; Training innovations and the role of research; Simulators; The instructor pilot; Topics for research. GRA

N71-25840# Michigan State Univ., East Lansing. Div. of Engineering Research.
A THEORY OF NEUROMIME NETS CONTAINING RECURRENT INHIBITION, WITH AN ANALYSIS OF A HIPPOCAMPUS MODEL Interim Scientific Report
Duane G. Lest and William L. Kilmer 29 Jan. 1971 105 p refs
(Grant AF-AFOSR-1023-67)
(AD-720815; AFOSR-TR-71-0705; ISR-15) Avail: NTIS CSCL 6/16

A functal net model of recurrent inhibition as found in the CA3 sector of mammalian hippocampus is presented. The model contains a rank of functals, which are somewhat like adaptive threshold logic units, and a rank of function generators, which are threshold logic units. The most important characteristic of the models input-output transformation is that a single input can be transformed into a sequence of outputs. A trainable functal net is

one in which the functions realized by its functals are under the control of an external structure called the trainer, which operates according to a specified algorithm. The CA3 model is incorporated into an automata theoretic model of the hippocampus that is designed to take advantage of certain of the CA3 models properties. The function realized by a functal system model whenever it is placed in a new environment is called the initial function. The selection of initial functions is discussed, and an algorithm is derived to select them automatically. Author (GRA)

N71-25841# Michigan State Univ., East Lansing. Div. of Engineering Research.

AN INTRODUCTION TO MULTICLASS PATTERN RECOGNITION IN UNSTRUCTURED SITUATIONS Interim Scientific Report

Albert Y. Hung and Richard C. Dubes 10 Dec. 1970 71 p refs

(Grant AF-AFOSR-1023-67)

(AD-720812; AFOSR-TR-71-0710; ISR-12) Avail: NTIS CSCL 6/4

The M-class pattern recognition problem is to construct a set of discriminant functions hwhich partition a feature space into M regions, one region per pattern class. Each point in the feature space is a potential pattern and each pattern represents an object. Almost nothing is assumed about the origins of the patterns. Distributions are not associated with the pattern classes. A set of training patterns is to be generalized into a set of discriminant functions which classify the potential patterns. The fundamental algorithms developed here concern the situation where the origin of each training pattern is known. An extension to the unsupervised case is also given. Several new multi-class decision-making algorithms are proposed. An entirely new class of algorithms is obtained by translating the pattern recognition problem into the problem of minimizing a function of several variables and selecting suitable functions. This general formulation includes most known algorithms as special cases. The class of algorithms includes all procedures which approximate discriminant functions by linear combinations of basis functions. Several sucessful two-class algorithms are extended to the M-class problem. Author (GRA)

N71-25842# Michigan State Univ., East Lansing. Div. of Engineering Research.

INFORMATION COMPRESSION, STRUCTURE ANALYSIS, AND DECISION MAKING WITH A CORRELATION MATRIX

Richard C. Dubes 1 Dec. 1970 242 p refs

(Grant AF-AFOSR-1023-67)

(AD-720811; AFOSR-TR-71-0707; ISR-11) Avail: NTIS CSCL 6/4

Correlation functions have spawned a wide variety of data processing methods in a number of scientific disciplines. Under the broad umbrella of pattern recognition methodology, this report summarizes and coordinates several digital computer algorithms, all based on correlation matrices, for reducing the size of a data matrix and for producing algorithms which classify patterns. Each row of the data matrix represents a pattern and each column represents a feature. Correlation-based cluster-seeking algorithms which provide information used in choosing a decision-making strategy are also discussed. Author (GRA)

N71-25847# Michigan State Univ., East Lansing. Div. of Engineering Research.

BAYESIAN DECISION MAKING AND LEARNING FOR CONTINUOUS-TIME MARKOV SYSTEMS

Erdal Panayirci and Richard C. Dubes 16 Nov. 1970 144 p refs

(Grant AF-AFOSR-1023-67)

(AD-720810; AFOSR-TR-71-0711; ISR-9) Avail: NTIS CSCL 6/4

The document is concerned with Bayesian decision making and learning algorithms for a particular problem in parametric pattern recognition in which each of a finite set of pattern classes is characterized by a continuous-time, discrete-state Markov process. The basic problem considered is that of determining rules for making decisions about the identity of the active pattern class based upon observation of a sample function in some finite interval. The stationary transition probability matrices for the processes in question are the parameters of the pattern classes. Author (GRA)

N71-25849# RAND Corp., Santa Monica, Calif.

AN EXPERIMENTAL INVESTIGATION OF THE EFFECT OF TARGET MOTION ON VISUAL DETECTION

D. J. Dugas and H. E. Petersen Feb. 1971 45 p refs

(Contract F44620-67-C-0045)

(AD-720800; R-614-PR) Avail: NTIS CSCL 5/10

The document reports an experiment comparing the detection probabilities for moving targets against complex backgrounds; compares the results to the Bailey model for detection of static targets in random search (see RM-6158); and extends that model to cover moving targets by modifying Baileys glimpse-aperture factor to reflect the fact that a moving target is 2 to 8 times as easily found as a static one. For an aerial-photograph background, the improvement was about 4 times. In the experiment, seven subjects viewed a television display of an artificial, electronically generated target at two speeds against an aerial photo of wooded terrain, against felt, and against a grid. Results suggest--but do not prove--that it is not the motion itself that improves detection performance, but the contrast changes that occur as the target moves over a complex background. Author (GRA)

N71-25850# Michigan State Univ., East Lansing. Div. of Engineering Research.

PATTERN RECOGNITION WITH CONTINUOUS PARAMETER, OBSERVABLE MARKOV CHAINS

Richard C. Dubes and Erdal Panayirci 25 Nov. 1970 35 p refs

(Grant AF-AFOSR-1023-67)

(AD-720837; AFOSR-TR-71-0715; ISR-10) Avail: NTIS CSCL 6/4

The paper develops Bayesian learning and decision-making algorithms for the following pattern recognition problem. Each of M pattern classes is described by a continuous-parameter, discrete-state Markov chain having a finite number of states. All states and times of transition between states can be observed perfectly. The transition rate matrices, which establish the properties of the chains, are not known a priori. A Bayesian learning algorithm using a fixed amount of memory digests the training patterns which consist of a member function from each chain. This leads to an iterative, computationally simple, decision-making algorithm for classifying any portion of a member function. The Bhattacharyya bound and the probability of error are derived for the 2-state, 2-chain problem when the transition rate matrices are known. The last section reports on a computer simulation of a 3-state, 2-chain problem with varying amounts of training data. An appendix summerizes the pertinent facts about Markov chains. Author (GRA)

N71-25863# Clark (David) Co., Inc., Worcester, Mass.

DESIGN AND FABRICATION OF A PASSIVELY PRESSURIZED SUIT Final Report, Jul. 1968 - Apr. 1970

Walter G. Pleskun and Joseph A. Ruseckas Jan. 1971 29 p refs

(Contract F33657-68-C-1663)

(AD-720827; AMRL-TR-70-120) Avail: NTIS CSCL 6/17

The purpose of the experimental effort was to evolve new designs and manufacturing technology applicable to high altitude pressure suits. Emphasis was placed on development of bladders using an elastomeric compound which would have excellent air

retention for extended periods of time, would have the capability to expand sufficiently to serve as a redundant segment for failed adjacent bladders and would be economical to fabricate. Additional emphasis was placed on the development of a restraint coverall which would satisfy the requirements for passive ventilation, unpressurized maximum mobility, acceptable pressurized mobility, long term comfort unpressurized, adequate skin pressure during pressurization and lowest possible weight. Author (GRA)

N71-25864# Michigan State Univ., East Lansing. Div. of Engineering Research.

COMMAND AND CONTROL MODELS HAVING BIOPHYSICAL ANALOGS Final Report

William L. Kilmer and Richard C. Dubes 15 Feb. 1971 44 p refs

(Grant AF-AFOSR-1023-67)

(AD-720816; AFOSR-TR-71-0696) Avail: NTIS CSCL 6/4

Sections of the report present the work done by Dr. Kilmer on the computer modeling of the hippocampus, and that by Dr. Dubes on data studies, pattern recognition, and information compression. Final sections summarize the personnel and publications related to this work. Author (GRA)

N71-25871# Michigan Univ., Ann Arbor.

GROUP EFFECTS ON INDIVIDUAL INFERENCES

Marcia Guttentag (City Univ. of N.Y.) and Gloria Wheeler [1970] 22 p refs Prepared in cooperation with City Univ. of N.Y.

(Grant NSF GY-5611)

Avail: Issuing Activity CSCL 05E

A Bayesian model is used to study group effects on individuals' subjective probability judgments. A probabilistic information task with a likelihood ratio response is utilized to establish whether the group effect will be not only to shift judgments in a riskier direction, but also whether this risky shift will be a shift in the direction of optimality. Experimental results show that cumulative odds groups are conservative while noncumulative likelihood ratio groups are veridical. G.G.

N71-25925# Ocean Systems, Inc., Tarrytown, N.Y. Research and Development Dept.

EFFECTS OF ENVIRONMENTAL PARAMETERS UPON COMBUSTION OF FIRE-RESISTANT MATERIALS, POTENTIAL ELECTRICAL SOURCES OF IGNITION AND ANALYSIS OF COMBUSTION PRODUCTS Summary Report, 1 Jan. 1970 - 31 Dec. 1970

Victor A. Dorr 1 Jan. 1971 54 p

(Contract N00014-70-C-0169)

(AD-720352; Rept-3) Avail: NTIS CSCL 6/11

Research during 1970 in the area of combustion safety in diving atmospheres has encompassed: Establishment of the relationship of gas composition, pressure and sample orientation on the rate of combustion of candidate materials for use in oxygen-enriched diving atmospheres; An evaluation of the correlation between small scale and large scale fir tests; An investigation of potential electrical sources of ignition in oxygen-enriched diving atmospheres; and Qualitative and quantitative analyses of the combustion products resulting from the burning of certain candidate materials. Author (GRA)

N71-25942*# General Electric Co., Philadelphia, Pa. Missile and Space Div.

STUDY OF APPLICATIONS OF BIO-SPACE TECHNOLOGY TO PATIENT MONITORING SYSTEMS Progress Report

Dec. 1970 304 p refs Conf. Held at Salt Lake City, 8 - 9 Dec. 1970

(Contract NASw-2073)

(NASA-CR-118645; PR-3) Avail: NTIS HC $6.00/MF $0.95 CSCL 06B

A patient monitoring system is defined with equipment specifications as formulated by a team of engineers and physicians, based on a survey of existing state-of-the-art systems followed by an evaluation of the systems. The capabilities of existing systems were improved by appropriate applications of aerospace technology. A systems engineering approach was used to define the system. The system is a modular one tailored to fulfill a variety of hospital requirements including the monitoring of cardiac, cardiovascular, pulmonary, and body chemistry (blood and urine) parameters. Minimum functional performance and test requirements are given. The monitoring system consists of an integrated set of sensors and medical electronic units for monitoring selected physiological patameters of patients, displaying information at a remote station and/or bedside, initiating out-of-limit alarms and automatic monitor switching, and the devices required for physiological stimuli. J.M.

N71-25943*# Man Factors, Inc., San Diego, Calif.

DATABOOK FOR HUMAN FACTORS ENGINEERS. VOLUME 2: COMMON FORMULAS, METRICS, DEFINITIONS

Charles Kubokawa, Wesley Woodson, and Peter Selby, eds. Nov. 1969 371 p refs

(Contract NAS2-5298)

(NASA-CR-114272) Avail: NTIS CSCL 05E

Formulas, nomographs, metrics, conversion tables, symbols, definitions, and abbreviations and acronyms are presented that may be required at some time during the project activities of typical human engineering specialists. Author

N71-25944*# Man Factors, Inc., San Diego, Calif.

DATABOOK FOR HUMAN FACTORS ENGINEERS. VOLUME 1: HUMAN ENGINEERING DATA

Charles Kubokawa, Wesley Woodson, and Peter Selby, eds. Nov. 1969 260 p

(Contract NAS2-5298)

(NASA-CR-114271) Avail: NTIS CSCL 05E

Typical human engineering data useful in determining optimum design characteristics of equipment operated or maintained by human operators and/or maintenance personnel are presented. Anthropometry and equipment design are discussed as well as environmental conditions, and metabolic and behavioral factors. Author

N71-25954# Ocean Systems, Inc., Tarrytown, N.Y. Research and Development Dept.

COMPENDIUM OF HYPERBARIC FIRE SAFETY RESEARCH Final Report, 1 Apr. 1966 - 31 Dec. 1970

Victor A. Dorr 28 Feb. 1971 34 p refs

(Contracts N00014-66-C-0149; N00014-70-C-0169)

(AD-720353) Avail: NTIS CSCL 13/12

Four years of research in hyperbaric fire safety is summarized and reviewed in the compendium. The following areas of study are considered: Environmental parameters affecting combustion in hyperbaric environments (Ignition temperature and ignition delay, flame spread rates in helium and nitrogen diving atmospheres, Minimum oxygen concentration necessary for combustion in hyperbaric environments, correlation between small scale and large scale testing, the upper flammability limits of hydrogen-oxygen mixtures); Potential electrical source of ignition; High-expansion foam fire extinguishing tests; and Screening of flame resistant materials. Author (GRA)

N71-26019*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

CONTROL ANALYSIS OF A REGENERATIVE CABIN

ATMOSPHERE SYSTEM

Robert D. Averill and Robert A. Smoak (Va. Univ.) Washington May 1971 87 p refs

(NASA-TN-D-6139; L-6674) Avail: NTIS CSCL 06K

The dynamic aspects of a typical atmosphere control system of the type suitable for earth-orbiting manned missions up to 1 year in length were studied. A dynamic, nonlinear model of the cabin atmosphere system was programmed on an electronic analog computer and sample cases were run at various conditions with both proportional and on-off system controllers. The study demonstrated that the cabin atmosphere control system model was basically stable with both types of controllers under normal operating conditions. Recovery of the system from assumed disturbances such as increased crew activity or cabin air-lock venting was marginal because of the limited capacity of the chosen components. Operation of the system with on-off controllers in an overloaded condition, representing an increase in the number of crew members during a resupply mode, resulted in a type of system instability with slight oscillations in cabin water vapor and carbon dioxide partial pressures. The results of the study indicate that transient system effects must be considered in future design studies of cabin atmosphere control systems for specific manned missions. Author

N71-26076# Applied Psychological Services, Wayne, Pa. Science Center.

DIGITAL SIMULATION OF THE PERFORMANCE OF INTERMEDIATE SIZE CREWS: APPLICATION AND VALIDATION OF A MODEL FOR CREW SIMULATION

Arthur I. Siegel, J. Jay Wolf, and Joseph Cosentino Feb. 1971 157 p refs

(Contract N00014-68-C-0262)

(AD-720354; APS-7071-5) Avail: NTIS CSCL 5/8

Based on current psychological theory, military doctrine, and previously developed and tested functional relationships, selected psychosocial, personnel, and performance variables are woven into a stochastic mathematical model for digitally simulating closed man-machine systems operated by crews of from 4 to 20 members. This probabilistic model is presented in terms of a detailed logic and processing flow sequence. An operational mission (Viet Nam river patrol) selected for the evaluation of the model is then described and quantified as required for input to the model. The results of a series of evaluative simulation runs, in which the computer simulation model is applied to the mission, are reported. These results are compared with independent criterion data for the same mission. Author (GRA)

N71-26138# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

SURVIVAL EQUIPMENT (AVIATION) Final Report

21 Jan. 1971 18 p

(AD-720225; MTP-7-3-095) Avail: NTIS CSCL 6/7

The document identifies test methods and techniques necessary to determine the degree to which aviation survival equipment meets army requirements. Author (GRA)

N71-26158# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

KINEMATIC ANALYSIS OF A SIX DEGREE OF FREEDOM VIBRATION TABLE Final Report, 1 Sep. 1969 - 15 May 1970

Darrell L. Wilburn and J. L. Kurzenberger Sep. 1970 41 p ref

(AD-720269; AMRL-TR-70-87) Avail: NTIS CSCL 14/2

A mathematic formulation of the Kinematic equations describing the motion of a six degree of freedom vibration table has been constructed for use in research on human subjects at the Aeropace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio. The background to the approach to the analysis is discussed and the derivation of the Kinematics equation is presented. A hybrid computer program is included that can be used to generate the solutions for the required lengths. The computer output can then be recorded on magnetic tape and used for analog inputs to the device. Author (GRA)

N71-26160*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

STUDIES OF MULTIVARIABLE MANUAL CONTROL SYSTEMS: A MODEL FOR TASK INTERFERENCE

William H. Levison, Jerome I. Elkind, and Jane L. Ward Washington NASA May 1971 229 p refs

(Contract NAS2-3080)

(NASA-CR-1746) Avail: NTIS CSCL 05E

The results of a study of multivariable manual control systems are presented. The objectives of this study were to investigate human performance in multivariable control and monitoring situations, to develop models for the controller in these situations, and to develop a metric for pilot workload. An extensive experimental study of multi-axis tracking performance is described. Data are presented for: (1) four-axis tracking tasks with visual scanning permitted among the four separate displays, (2) multi-axis tracking with fixation maintained on a single display, and (3) a complimentary set of single-axis tracking tasks with foveal and peripheral viewing of the display. Multi-axis behavior is shown to be consistent with single-axis results. A model is presented for interference among multiple control tasks. This model is based upon the assumption that multiple tasks are performed in parallel and that the human must share a fixed amount of central-processing capacity among the tasks. Validation is provided by a comparison of model predictions with experimental results obtained from multi-axis control situations and from a single-axis, multivariable control situation. A metric for pilot workload is suggested which is based upon the model for task interference. Author

N71-26174# Conductron-Missouri, St. Charles.

TRAINING POTENTIAL OF INFLIGHT AUDIO/VISUAL RECORDING EQUIPMENT FOR THE F-4E AIRCRAFT

Robert L. Klamm, Delbert Jacobs (AFSC, Wright-Patterson AFB, Ohio), and Herbert J. Clark (Tactical Fighter Weapons Center, Nellis AFB, Nev.) Wright-Patterson AFB, Ohio Air Force Human Resources Lab. Dec. 1970 38 p ref

(Contract F33615-69-C-1816)

(AD-720245; AFHRL-TR-70-25) Avail: NTIS CSCL 5/9

This report presents a detailed description of an Audio/Video Recording System developed to study the feasibility and training potential of in-flight video recordings through the gunsight and of the instrument panel of an F-4E aircraft. The purpose of the study was to assess the value of the system as an aid in air-to-air and air-to-ground gunnery training. Flight tests were conducted in an F-4E aircraft at Nellis AFB, during which air-to-air and air-to-ground weapon delivery missions were recorded. Results of the tests proved the value of audio/video recording for training and mission evaluation, but indicated a requirement for a higher resolution video system. Additional advantages and limitations of the equipment and the tape recordings obtained are described, and it is recommend that additional tests be made with equipment capable of producing higher resolution video tapes. Author (GRA)

N71-26196* Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

HORIZONTAL STATIC FORCES EXERTED BY MEN STANDING IN COMMON WORKING POSITIONS ON SURFACES OF VARIOUS TRACTIONS, INCLUDING COEFFICIENTS OF FRICTION BETWEEN VARIOUS FLOOR AND SHOE MATERIALS

K. H. E. Kroemer and Danny E. Roberson (Antioch Coll.) Jan. 1971 44 p refs

(AD-720252; AMRL-TR-70-114) Avail: NTIS CSCL 5/5

Experiments were conducted to measure maximal isometric horizontal push forces. Twenty-eight male subjects pushed forward with both hands, laterally with the preferred shoulder, and with their backs. Reaction force for body stabilization was provided by a vertical wall, a footrest, or by floor-shoe combinations with coefficients of static friction of approximately 1.0, 0.6, and 0.3. Means, standard deviations, and 5th percentiles of the exerted forces are reported. In comparing the experimental data with results previously published, it is concluded that body weight cannot serve as a reliable predictor for push force capability from floors of various tractions. Estimates for static horizontal push as well as pull force capabilities of one or several men are tabulated in relation to traction available to the operator. An appendix contains coefficients of static friction between nineteen floor materials and eight shoe materials. Author (GRA)

N71-26293* General Dynamics Corp., San Diego, Calif. Space Labs.

METHOD AND APPARATUS FOR ATTACHING PHYSIOLOGICAL MONITORING ELECTRODES Patent

John M. Keating, James. A. Roman, Robert G. Green, and Charles W. Patten, inventors (to NASA) Issued 11 Feb. 1969 9 p Filed 10 Oct. 1966 Cl. 128-2.06; Int. Cl. A61b5/05; Int. Cl. B05b15/04 Sponsored by NASA

(NASA-Case-XFR-07658-1; US-Patent-3,426,746; US-Patent-Appl-SN-586324) Avail: US Patent Office CSCL 06B

An adhesive spray process and instrumentation are described for fastening a biomedical electrode to the skin of a subject. This method permits biomedical monitoring of various physiological functions reflected in minute electrical potentials. G G

N71-26295*# Hamilton Standard, Windsor Locks, Conn.

COMPUTERIZED ANALYTICAL TECHNIQUE FOR DESIGN AND ANALYSIS OF A SABATIER REACTOR SUBSYSTEM Final Engineering Report

R. A. Baum, Jr., F. L. Kester, and P. J. Lunde [1971] 385 p (Contract NAS9-9844)

(NASA-CR-115028; SVHSER-5082) Avail: NTIS HC $6.00/MF $0.95 CSCL 06K

The Sabatier reaction is a vital step in the recovery of oxygen from carbon dioxide in many spacecraft life support systems. The kinetics of the Sabatier reaction are determined and a mathematical description of the reaction useful for steady state and transient conditions is used to solve such a model on a digital computer. The Sabatier kinetics were determined with sixty-eight tests using a small reactor filled with a commercial catalyst held at a constant temperature and pressure and fed with unreacted and partly reacted feed gases. Analysis was by gas chromatography. Activation energy found was 30,600 btu/lb-mol CO2. Limited comparisons of the mathematical computer model with test data were made. Agreements of + or − 20 F in temperature distribution and + or − 1% in conversion were achieved. Author

N71-26333* Hamilton Standard, Windsor Locks, Conn.

VENTING DEVICE FOR PRESSURIZED SPACE SUIT HELMET Patent

Alfred A. Gran and Ronald Lang, inventors (to NASA) Issued 21 Oct. 1969 5 p Filed 27 Feb. 1967 Cl. 2-6; Int. Cl. A42b3/00; Int. Cl. A62b18/04 Sponsored by NASA

(NASA-Case-XMS-09652-1; US-Patent-3,473,165; US-Patent-Appl-SN-618969) Avail: US Patent Office CSCL 06Q

A venting device comprising a fixture mounted in the faceplate of a crewman's helmet for use with a pressurized space suit is described. The device incorporates valve means providing controlled venting of the helmet in the oral-nasal area. The device also has a collapsible duct or funnel positionable between a collapsed stowed condition adjacent the faceplate, and an operating position in which it projects into abutment with the mouth of the crewman. The device is used for the elimination of vomit expelled by the crewman. Official Gazette of the U.S. Patent Office

N71-26366*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

GENERAL MEASUREMENT PROBLEM AREAS

In its Sixth Transducer Workshop 1969 p 65−119 refs (See N71-26363 14-14)

Avail: NTIS CSCL 06B

Applications of standard transducers to the specialized area of bioengineering are presented. Off-the-shelf transducers are used in three research programs: (1) the evaluation of left ventricular work in man by the thermal dilution technique, essentially a temperature measuring problem; (2) the evaluation of the friction drag of biological fluids in contact with technological and biological surfaces, a drag or force measuring problem; and (3) the effects of high pressure (50 atmos) and dissolved gases on the viscosity of blood, and blood derivatives, a pressure measuring problem. Author

N71-26371# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.

COMBAT AIRCREW RESCUE SIMULATION Summary Report

Francis W. Smejkal Nov. 1970 73 p

(AD-720238; ASD/XR-70-20) Avail: NTIS CSCL 6/7

A description is given of a simulation model of combat aircrew rescue operations. This model is concerned only with the combat aircrew rescue mission. The engine-airframe contribution to rescue mission success is the factor being evaluated in the model. Effects of reliability, maintainability, and survivability are not considered. The report discusses the model structure and all underlying assumptions. Data required to operate the model are listed. In the appendices, a detailed and annotated program flow is given. Additionally, all equations used are derived and their use and application explained. Author (GRA)

N71-26390*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.

EVALUATION OF ABSORPTION CYCLE FOR SPACE STATION ENVIRONMENTAL CONTROL SYSTEM APPLICATION Interim Report

D. V. Hale, J. Thoenes, and C. K. Liu Mar. 1971 177 p refs (Contract NAS8-25986)

(NASA-CR-103114; LMSC-HREC-D782909; HREC-5986-1) Avail: NTIS CSCL 06K

Fluids were selected on the basis of minimum system weight, minimum radiator area, low power consumption, and safety and operational requirements. Cycle, fluid, and component weight equations were compiled into a computer program for analyzing the refrigeration cycle. From the parametric analyses a test design condition was selected. Safety and stability requirements resulted in the selection of R-22 and dimethyl ether of tetraethylene gylcol (DME-TEG) with a radiator temperature of 250 F. The program identified all design conditions including temperatures, flow rates, enthalpies, pressures and concentrations at every point in the cycle. Weights and areas were defined as well. The generator, separator, and recuperator components were designed, fabricated and installed with the absorber for closed loop testing of the total absorbent flow loop. The total system was scaled to 1/53 of the total 35 kW system. Detailed analyses used in determining the component designs are presented, as well as detailed test procedures and results. The general conclusion was that the zero-gravity absorption refrigeration system is feasible for use as an environmental control refrigerating system in space vehicles. Author

N71-26410*# Michigan Univ., Ann Arbor. Engineering Human Performance Lab.

GRAPHICAL PREDICTIONS OF HUMAN STRENGTHS FOR TWO-HANDED IVA/EVA TASKS, PHASE 1
Apr. 1971 176 p refs
(Contract NAS9-10973)
(NASA-CR-115014) Avail: NTIS CSCL 05E

Strength predictions are presented based on simulations performed with a computerized biomechanical model. Separate sections contain the following: (1) The development of the computerized model used in the simulations is described followed by a detailed presentation of the input data used for specific simulations. (2) Two-handed strength predictions are presented graphically for shirt sleeved activities as a function of hand positions, population size and strength, and gravity conditions. A summary of some general factors affecting strength capabilities is included. (3) Predictions are presented of two-handed force capabilities with an inflated A7L space suit and the PLSS and OPS backpacks. (4) A summary is given of the more general effects found from two-handed force predictions along with a discussion of the limitations and possible extensions of the results. D.L.G.

N71-26566# Forsvarets Forskningsanstalt, Stockholm (Sweden). Avdelning 1.
EXPERIENCES IN THE FIELD OF CLEANLINESS TECHNIQUE IN SWEDEN [ERFAHRUNGEN AUF DEM GEBIET DER REINHEITSKONTROLLE IN SCHWEDEN]
Bertil Wedin Sep. 1969 11 p In SWEDISH Presented at Dechema Jahrestagung, Frankfurt, 27 Jun. 1969
(FOA-1-C-1325-76) Avail: NTIS

Intensified cleanliness control has led to considerable economic benefits for the Swedish airforce and the State Bacteriological Laboratory. The percentage error in manufactured ball bearings and polio and immunizing vaccines has fallen to a very large extent or has been wholly eliminated. Another progressive stage in the control of cleanliness stems from the production and use of aerosol filter material based on glass fibers, the construction of instruments for the analyses of airborne organic compounds and progress in collection methods for microorganisms and identification of microorganisms by means of fluorescing antibodies. Author

N71-26822# Joint Publications Research Service, Washington, D.C.
SOME ASPECTS OF THE NUTRITION OF AQUANAUTS IN UNDERWATER LABORATORIES AND IN WATER
Yu. M. Barats et al 18 May 1971 7 p refs Transl. into ENGLISH from Vopr. Pitaniya (Moscow), no. 2, 1971 p 17–22
(JPRS-53161) Avail: NTIS

The results of observations on the experimental nutrition of aquanauts in an underwater station of the open type and in weightlessness are presented. Based on an analysis of the observations and the literature data, the dietary requirements of aquanauts are discussed. The possibility of satisfying these requirements are examined. Author

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N71-25607# Tennessee Univ., Knoxville. Dept. of Chemistry.
NEW SUBVALENT MERCURY ION IN MOLTEN CHLOROALUMINATES
G. Torsi and G. Mamantov 1970 5 p refs Presented at the Amer. Chem. Soc. Regional Meeting, New Orleans, 2–4 Dec. 1970
(Contract AT(40-1)-3518)
(CONF-701204-1) Avail: NTIS

Evidence is given for the discovery of an Hg sub 3 (II)ion found in the acidic chloroaluminate melts of (AlCl3/NaCl ratio > 1). No information on the number of Cl(−) ions involved in each half reaction was obtained. Spectral observations and polarograms for the ion are given. E.H.W.

N71-25673# Princeton Univ., N.J. Frick Chemical Lab.
THERMAL STABILITY OF HYDROCARBON NETWORKS BY CHEMICAL STRESS RELAXATION
Montgomery T. Shaw and Arthur V. Tobolsky Feb. 1971 19 p refs
(Contract N00014-67-A-0151-0011)
(AD-719916; ONR-TR-RLT-131) Avail: NTIS CSCL 7/4

The thermal stability of hydrocarbon networks by chemical stress relaxation was investigated in vacuum and in the temperature range 300C - 350C. The polymers studied were low density polyethylene, high density polyethylene and ethylene-propylene terpolymer. Carbon-carbon crosslinked networks were produced either by dicumyl peroxide or by radiation. The results show that the overall thermal stability is in the order: peroxide cured EPT > peroxide cured LDPE > peroxide cured HDPE > radiation cured HDPE. The results are in apparent contradiction to the belief that linear structures are more stable than branched structures. We believe that this can be explained in terms of weak linkages introduced during curing. Scission probably occurs at weak linkages, at crosslinkages, and along the main chain. Author (GRA)

N71-25727*# Translation Consultants, Ltd., Arlington, Va.
ON UNDERSTANDING HISTIDINE: PEPTIDE FORMATION VIA ACYL MIGRATION [ZUR KENNTNIS DES HISTIDINS, PEPTIDBILDUNG DURCH ACYLWANDERUNG]
M. Bergmann et al Washington NASA May 1971 10 p refs Transl. into ENGLISH from Z. Physiol. Chem. (Berlin), v. 175, 1928 p 145–153
(Contract NASw-2038)
(NASA-TT-F-13645) Avail: NTIS CSCL 07D

The formation of various histidine esters by means of acyl migration from one amino acid to another is discussed. Author

N71-25728*# Translation Consultants, Ltd., Arlington, Va.
NOTE ON THE SYNTHESIS OF d,1-HISTIDYLGLYCINE [NOTIZ UEBER SYNTHESE EINES D,1-HISTIDYL-GLYCIN]
M. Bergmann et al Washington NASA May 1971 5 p refs Transl. into ENGLISH from Z. Physiol. Chem. (W. Berlin), v. 175, 1928 p 154–157
(Contract NASw-2038)
(NASA-TT-F-13672) Avail NTIS CSCL 07D

The synthesis of d, 1-histidylglycine from acetyl-d, 1-histidyl-glycine ethyl ester is discussed. Author

N71-25793# McElroy (Ralph) Co., Austin, Tex.
INVESTIGATION CONCERNING THE RADIOLYTIC EVOLUTION OF GASES IN THE HANDLING OF MATERIALS CONTAINING PLUTONIUM
B. Oesterdahl Mar. 1970 10 p refs Transl. into English from SWEDISH report Prepared for AEC
(AEC-tr-7217) Avail: NTIS

Water solutions containing plutonium evolve gas caused by a radiolysis of water in the presence of alpha radiations from plutonium. The gas yield varies depending on the ions and molecules present in the solution. The number of possible reactions in a solution that may not be a very simple compound are so great that a theoretical calculation is very complicated. Some experimental work is reviewed. It was found that the amount of gases evolving from radiolysis is a potential hazard when sealed containers are used. Author (NSA)

N71-25798# Bureau of Mines, Washington, D.C.
REACTIVITIES OF EXHAUST ALDEHYDES
B. Dimitriades and T. C. Wesson May 1971 21 p refs Sponsored in part by HEW
(BMRI-7527) Avail: Issuing Activity

Data on smog-forming reactivities of exhaust aldehydes are scarce. Such data were obtained by irradiating in a smog chamber typical exhaust aldehydes, individually and in exhaustlike mixtures. Observed reactivity manifestations were rate of nitrogen dioxide formation and yields of oxidant, peroxy-acetyl nitrate, and formaldehyde. Results showed that exhaust aldehydes vary widely in reactivity. Formaldehyde showed high reactivity but low oxidant yield; benzaldehyde, m-, and p-tolualdehyde were totally unreactive when irradiated individually; o-tolualdehyde was reactive. In mixtures, benzaldehyde manifested reactivity in terms of peroxybenzoyl nitrate yield. Exhaust aldehydes as a group are judged to be as reactive as the exhaust olefin group. The importance of the aldehyde contribution to exhaust reactivity and methods for assessing such contribution are discussed. Author

N71-25919*# Moser, Chico, Calif. Dental Manufacturing Div.
STUDY OF THE SEDIMENTATION VOLUME OF UNIFORM AND NONUNIFORM SIZED PARTICLES OF UNIFORM AND NONUNIFORM SURFACE ENERGIES Final Report, 15 Dec. 1969 – 15 Sep. 1970
15 Sep. 1970 72 p refs
(Contract NAS7-775)
(NASA-CR-118834) Avail: NTIS CSCL 07D

A brief summary of research on the ordering and packing of particles in composite systems is given. The calibration of the rotational viscometer is outlined with a description of the instrument. Polypropylene oxide and mineral oil suspending medium viscosities were determined as well as sedimentation volumes and viscosities of silver alloy powder and slurried and unslurried glass beads and aluminum powder in the suspending media. The effects of uniform and nonuniform particle size and surface energy on the viscosities and sedimentation volumes are discussed. J.M.

N71-25928# Air Force Systems Command, Edwards AFB, Calif. Rocket Propulsion Lab.
THE VIBRATIONAL EXCITATION OF HF BEHIND INCIDENT SHOCK WAVES Research Report, Jul. – Nov. 1970
W. C. Solomon, J. A. Blauer, T. W. Owens, and J. G. Hnat Feb. 1971 28 p refs
(AD-720819; AFRPL-TR-71-9) Avail: NTIS CSCL 7/4

The vibrational excitation of HF occurring behind incident shock waves has been studied in the temperature range of 1400 K to 4100 K. The extent of excitation was determined as a function of time by continuously monitoring the emission intensity from the 1-0 band of HF centered at 2.5 microns. The data were interpreted in terms of the process HF(0) + M = HF (1) + M. The corresponding result for (tau p) minus 1 was found to be insignificant in comparison to this result. Data were also obtained for the effect of F atoms upon the relaxation rate. GRA

N71-25929* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NOVEL POLYCARBOXYLIC PREPOLYMERIC MATERIALS AND POLYMERS THEREOF Patent
Harold E. Marsh, Jr. and John J. Hutchison, inventors (to NASA) Issued 19 Jan. 1971 4 p Filed 30 Aug. 1968 Cl. 260-2.5; Int. Cl. C08g20/00, 20/26, 53/08 Sponsored by NASA
(NASA-Case-NPO-10596; US-Patent-3,557,027; US-Patent-Appl-SN-756381) Avail: US Patent Office CSCL 07D

Prepolymers and self foaming, high temperature resistant polymers are disclosed. The polymers are prepared by the reaction of a relatively high molecular-weight essentially saturated aliphatic hydrocarbon polycarboxylic terminated prepolymer and a polyisocyanate, preferably an aliphatic isocyanate such as hexamethylenediisocyanate. Carbon dioxide is evolved as a result of the reaction and a uniform cell structure product is formed. Cell size can be controlled by the addition of non-gas evolving cross linking agents such as polyols or diaziridines. The carboxyl terminated material is preferably a prepolymer having a star shaped configuration, for example, dimers or trimers of unsaturated C12 to C24 fatty acids or polyesters. In an example of the latter prepolymer, three moles of dimerized linoleic acid and two moles of 1,10-decane diol yields a carboxyl terminated polyester suitable for use in the polymerization reaction of the invention. Official Gazette of the U.S. Patent Office

N71-25941# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
PRACTICAL TREATMENT OF COUPLED GAS EQUILIBRIUM Final Report
Max Klein Arnold AF Sta., Tenn. AEDC Mar. 1971 70 p refs Sponsored by AEDC
(AD-720804; AEDC-TR-71-52) Avail: NTIS CSCL 7/4

Equations are derived for the species concentrations in coupled chemical equilibria in the gas phase. This is done both for the method of the direct minimization of the free energy as well as for the equilibrium constant method. The relations developed are such as to allow for the inclusion of detailed real gas effects. The emphasis is on practical problems encountered in the actual calculation of the species and the thermodynamic properties. Expressions are derived for the direct calculation of the concentration derivatives with respect to temperature and density required for the calculation of the derived properties (i.e., specific heats, sound velocities, etc.). Considerable space is given to discussions of the non-linear numerical methods available for the solution of the non-linear equations for the species concentrations. Author (GRA)

N71-26028*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PHOTOCHEMISTRY OF UNSATURATED POLYMERS
Morton A. Golub May 1971 25 p refs Presented at the Intern. Conf. on Chem. Transformations of Polymers, Bratislava, 22 – 24 Jun. 1971
(NASA-TM-X-62021) Avail: NTIS CSCL 07D

The mechanisms of the direct photochemical reactions which occur in unsaturated polymers when irradiated as thin films in vacuo are reviewed. Important reactions in 1,4-polyisoprene and 1,4-polybutadiene are cis-trans isomerization, loss of 1,4-unsaturation, formation of new external double bonds (vinylidene and/or vinyl units) and cyclopropyl formation. In 1,2-polybutadiene and 3,4-polyisoprene, on the other hand, the main reaction is consumption of the external double bonds through cyclization. Research on the photoinduced microstructural changes in cis and trans polypentenamers is also discussed. Author

N71-26029# Du Pont de Nemours (E. I.) and Co., Circleville, Ohio. Film Dept.
X-RAY LOW ANGLE SCATTERING FROM ORIENTED POLYMER FILMS
C. J. Heffelfinger and E. L. Lippert, Jr. [1970] 67 p refs Presented at the Symp. on Polymer Morphol., Columbus, Ohio, Jun. 1970 Submitted for publication
Avail: NTIS

Polyethylene terephthalate was chosen as a model polymer system for study. A systematic series of uniaxially and biaxially deformed films were produced from the polymer, made from the initially glassy or crystalline states. The low angle X-ray scattering patterns generated from the films were studied as a function of the sequence of deformation, the precursor structure, molecular orientation, and the direction of observation. Optical diffraction and model structures were used to aid in the interpretation of the morphology produced. At least three different sized domains were

developed upon deformation ranging from that of the unit cell (about 10A) to large laminar domains of average size 2,000A × 10,000A. The structure is shown to be substantially different from that developed in a biaxially oriented polyethylene film. Author

N71-26030*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RADIATION-INDUCED PREPARATION OF ANTIMONY FROM SOLUTIONS OF ANTIMONY(III) CHLORIDE IN ORGANIC LIQUIDS
Warren H. Philipp and Stanley J. Marsik Washington May 1971 10 p refs
(NASA-TN-D-6358; E-6153) Avail: NTIS CSCL 07D

The yield of antimony metal (Sb) from the irradiation with 2 MeV electrons of antimony (III) chloride solutions in a variety of anhydrous organic liquids is presented. The yield of atoms of Sb per 100 eV multiplied by the valence change n = 3 ranged from 0 to 3.71; the product contained from 85 to 99.9+ percent Sb. Best yields and highest Sb purity were obtained from primary alcohols. For the two liquids tested, the yield increased with antimony (III) chloride concentration. The application of anhydrous organic systems to the deposition of metals in general is briefly discussed. Author

N71-26082# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMOGRAVIMETRIC ANALYSIS OF HYDROFLUORIDES OF ALKALINE EARTH METALS
D. D. Ikrami et al 15 Dec. 1970 9 p refs Transl. into ENGLISH from Akad. Nauk Tadzh. SSR, Dokl. (USSR), v. 13, no. 1, 1970 p 40–43
(AD-720744; FTD-HT-23-827-70) Avail: NTIS CSCL 7/4

It was found that the most thermically stable hydrofluorides are the polyfluorides of strontium and barium. The thermal stability of BaF2.HF > SrF2.HF. The decomposition of the highest hydrofluorides, SrF2.2.5HF, BaF2.3HF, and BaF2.4.5HF, occurs stepwise and through formation of the polufluorides MF2.HF. Author (GRA)

N71-26083# Battery Corp. of America, Red Bank, N.J.
TRANSIENT METHODS FOR ANALYSIS OF ELECTROCHEMICAL KINETICS Final Report, 1 Oct. 1969–30 Sep. 1970
Jorge E. A. Toni Jan. 1971 46 p refs
(Contract DAAB07-70-C-0045)
(AD-720604; ECOM-0045-F) Avail: NTIS CSCL 7/4

The final report includes a series of applications of transient methods to real electrode process studies. The investigation covered the employment of methods involving linear variation of the imposed potential with time, relaxation techniques under potentiostatic control and methods under mass transfer by forced convection. The techniques of linear sweep voltammetry, potentiostatic step pulses and rotating ring-disc electrode were widely applied in the research problems studies. The report includes the results and discussions in the following areas: A new circuit for the independent control of two working electrodes, (ring-disc assembly, for example) in the same electrolyte is described, it was proved that the films formed on a cadmium electrode surface during its oxidation in KOH solutions are potential, KOH concentration and time dependent; and an electrode mechanism of the oxidation of cobalt metal in KOH solutions, consistent with the experimental results, was postulated. Author (GRA)

N71-26218 New Hampshire Univ., Durham.
A PRACTICAL COMPARISON OF ATOMIC FLUORESCENCE FLAME SPECTROMETRY WITH ATOMIC ABSORPTION FLAME SPECTROMETRY
Michael Andrew Pleva (Ph.D. Thesis) 1970 128 p
Avail: Univ. Microfilms Order No. 70-11810

A comparison of analytical determination techniques is presented. The techniques considered are: (1) atomic absorption flame spectrometry and (2) atomic fluorescence flame spectrometry. It is concluded that no significant superiority of fluoresence flame spectrometry over absorption flame spectrometry could be established. The technique selected depends upon the type of material and the detection limits involved. Author

N71-26262 Texas A&M Univ., College Station.
THE DETERMINATION OF TRACE LEVELS OF OXYGEN AND CARBON BY CHARGED PARTICLE ACTIVATION ANALYSIS
Harry Lorenz Rook (Ph.D. Thesis) 1969 114 p
Avail: Univ. Microfilms Order No. 70-11577

A study of the trace determination of oxygen and carbon by charged particle activation analysis is presented. Using the equivalent thickness method of quantitation, three factors were considered of prime importance to insure valid results. First, accurate and well defined activation curves of the nuclear reactions being employed were obtained. Second, all interfering reactions were experimentally categorized to insure the integrity of the radioisotope used for analysis. Third all usable reactions for the analysis of a given element were investigaged to allow the best possible choice of reactions for analysis in a given matrix and impurity level. Analytical results are given for the nondestructive determination of oxygen in silicon and aluminum in the part per million to the part per billion range. Results of some selected samples are compared to results independently obtained by infrared spectroscopy. Dissert. Abstr.

N71-26311 California Univ., San Diego.
A SHOCK-TUBE INVESTIGATION OF THE CHEMICAL KINETICS OF NO-CO-Ar MIXTURES
Lewis Phillip Leibowitz (Ph.D. Thesis) 1969 375 p
Avail: Univ. Microfilms Order No. 70-12850

The chemical reactions in NO-CO-Ar mixtures were studied behind the reflected shock wave in a pressure driven shock tube over the range of temperatures from 3000 to 4500 K. The reactions were followed by making time resolved measurements of emission intensity from the fundamental bands of CO2 and from a spectral region containing the gamma- and beta-bands of NO. Measurements were made on gas mixtures with variable NO and CO mole fractions. A reaction scheme was proposed to describe the important chemical processes occurring in NO-CO-Ar mixtures. Numerical solutions to the rate equations were obtained for the conditions used in the experimental investigations. From the CO2 concentration-time histories and the temperature-time histories, calculated CO2-emission-intensity-time histories were obtained. Comparisons between the experimental and calculated intensity-time histories were made by using characteristic times for CO2 formation and also by direct comparisons. A highly simplified scheme for the treatment of reaction processes in NO-CO-Ar mixtures was developed. Dissert. Abstr.

N71-26433 Brown Univ., Providence, R.I.
THE VISCOSITY OF COMPRESSED NITROGEN, HELIUM, HYDROGEN, AND ARGON FROM – 100 C TO 25 C
John Alexander Gracki (Ph.D. Thesis) 1969 148 p
Avail: Univ. Microfilms Order No. 70-8724

The absolute viscosities of N2, He, H2, and Ar were measured over the approximate range of 5 to 200 atm at 25 deg, minus 50 deg, and minus 90 deg (for N2 and He) or minus 100 C (for H2 and Ar); the results are believed to be accurate to 0.1 minus 0.2%. The apparatus was, with slight modifications, the constant volume capillary flow viscometer. In this apparatus, gas is forced through a capillary of precisely known dimensions at a known

constant flow rate, producing across the capillary a steady state pressure difference which is then measured with a mercury-in-steel manometer. The pressure differences, measured as a function of flow rate, include a correction for inlet effects, the viscosity being obtained by extrapolation to zero flow rate. For each of the capillaries, m was determined empirically as before, except that higher pressure differences were more heavily weighted. Agreement with previous data obtained with this viscometer was usually reasonable. Dissert. Abstr.

N71-26454# Joint Publications Research Service, Washington, D.C.
SOME METHODOLOGICAL ASPECTS OF CHEMICAL KINETICS
N. M. Emanuel *In its* Vestn. of the USSR Acad. of Sci., Vol. 40, No. 6, 1970 31 Aug. 1970 p 76–92 refs (See N71-26452 14-30)
Avail: NTIS

Chemical reaction kinetics are cited in examples of sudden transitions of quantity into qualitative changes. Considered are kinetic curves for radioactive decay characterizing the mean atomic lifetimes of an element, oxidation of a 2H2 + O2 mixture within the region of chain combustion; the kinetic curve of an exponentially growing tumor, and other examples where knowledge of the kinetics of a detailed mechanism is used as analytical method. G.G.

N71-26462# Joint Publications Research Service, Washington, D.C.
THE MECHANISM AND KINETICS OF HETEROGENEOUS REACTIONS (SYMPOSIUM IN MOSCOW)
V. A. Seleznev et al *In its* Vestn. of the USSR Acad. of Sci., Vol. 40, No. 6, 1970 31 Aug. 1970 p 149–153 refs (See N71-26452 14-30)
Avail: NTIS

Interactions of substances that take place on an interface are studied for their mechanisms and kinetics. Primarily considered are heterogeneous catalysis and reactions of solids with gases, liquids and other solids which are the basis for syntheses of catalysts, semiconducting materials, etc. The mechanisms and kinetics of catalytic reactions are emphasized and the mechanisms of reactions with participating solids are illuminated. G.G.

N71-26463# Joint Publications Research Service, Washington, D.C.
URGENT PROBLEMS OF CHEMICAL KINETICS (CONFERENCE IN MOSCOW)
V. N. Kondratyev *In its* Vestn. of the USSR Acad. of Sci., Vol. 40, No. 6, 1970 31 Aug. 1970 p 154–156 refs (See N71-26452 14-30)
Avail: NTIS

Theoretical aspects of the kinetics of elementary processes and the results of investigations on gaseous phase reactions and reactions in the condensed phase were studied. Calculations of rate constants and the applications of semi-empirical and purely empirical methods were used in studies on: molecular dissociation, entropic factors, fluorine reaction kinetics with hydrogen, oxygen, and acetylene, and for electron paramagnetic resonance methods in atomic reaction kinetics. G.G.

N71-26580# Du Pont de Nemours (E. I.) and Co., Richmond, Va. Film Dept.
SIMULATION OF THE KINETICS OF AN AQUEOUS EMULSION COPOLYMER SYSTEM
V. C. Haskell and Paul H. Settlage [1970] 10 p refs
Avail: NTIS

A mathematical model of the polymerization process was set up and programmed for a digital computer (Univac 1108). The polymers considered were limited to three or four component copolymers in which vinylidene chloride is the major component. Besides leading to improved process and product control, such an analysis has given further insight into the mechanism of emulsion polymerization generally. Author

N71-26582# California Univ., Berkeley. Dept. of Chemical Engineering.
SOLVENT EFFECTS ON THE VISCOSITY OF MODERATELY CONCENTRATED POLYMER SOLUTIONS
K. S. Gandhi and Michael C. Williams [1971] 50 p refs
Avail: NTIS

Viscosity eta sub 0 and osmotic pressure pi were measured for polymer solutions at 25 C, for concentrations up to 30 g/dl. To elucidate the effects of polymer-solvent interactions of various types, the systems chosen were polystyrene in toluene (good solvent) and decalin (poor solvent), and polymethyl-methacrylate in chlorobenzene (good) and m-xylene (poor). The surprising result was the generalization that eta sub 0 for poor-solvent systems increases with concentration faster than for good solvent systems, so that eventually eta sub 0 becomes far greater with poor solvents. This behavior is enhanced with polar polymers. It is believed that polymer aggregation occurs in poor solvents, independent of molecular weight effects. Data were correlated with both the powerlaw and the Simha methods. Theories for the Huggins constant were found to be inadequate, as was a model proposed earlier for concentrated solutions. Author

N71-26609# Forsvarets Forskningsanstalt, Stockholm (Sweden).
FLUORINE COMPOUNDS AS A MEANS OF OXIDATION: AN INVESTIGATION INTO AVAILABLE LITERATURE [FLUORHALTIGA OXIDATIONSMEDEL: EN LITTERATURUNDERSOEKNING]
Per Olof Granbom Oct. 1969 57 p refs In SWEDISH
(FOA-1-A-1502-42(46,40)) Avail: NTIS

Weakly bound compounds of fluorine with halogens, acids, nitrogen, and oxygen are evaluated for their use as high energy oxidizers in rocket fuels. Compiled and briefly described are particular suitable fluorine combinations for rocket fuel ignitions. Transl. by G.G.

N71-26639# Maryland Univ., College Park. Inst. for Molecular Physics.
TRIPLE COLLISION EFFECTS IN THE THERMAL CONDUCTIVITY AND VISCOSITY OF MODERATELY DENSE GASES, PART 2 Technical Report, 1 Sep. 1968–31 Aug. 1970
Daniel T. Gillespie and Jan V. Sengers Arnold AF Sta., Tenn. AEDC Mar. 1971 170 p refs
(Contract F40600-69-C-0002)
(AD-720251; AEDC-TR-71-51-Pt-2) Avail: NTIS

Calculations of transport properties of dilute gases are always based on the Boltzmann equation. The Boltzmann equation accounts only for the effects of collisions between two gas molecules. To predict transport properties of moderately dense gases one needs to determine the effects of collisions among more than two gas molecules. The report studies the contributions to the transport properties caused by collisions among three gas molecules. It is demonstrated that the first density correction to the transport properties can be represented by a series of collision integrals associated with one, two, three and four collisions between three gas molecules. Numerical studies for calculating the dominant collision integrals are made for a gas of hard spherical molecules. Author (GRA)

N71-26740# National Bureau of Standards, Washington, D.C.
CRITICAL MICELLE CONCENTRATIONS OF AQUEOUS

SURFACTANT SYSTEMS
Pasupati Mukerjee (Wis. Univ., Madison) and Karol J. Mysels (Reynolds (R. J.) Tobacco Co.) Feb. 1971 229 p refs
(NSRDS-NBS-36) Copyright. Avail: SOD $3.75

Critical micelle concentrations (CMC's) were collected, organized and evaluated. The literature was scanned for numerical values from 1926 up to and including 1966. In addition, over 800 values, hitherto available only in graphical form or implied in experimental data, were extracted from the publications and are included. Close to 5,000 entries, based on 333 references, dealing with 720 compounds are tabulated in the main tables. Whenever available, the temperature, any additives present, the method of determination and the literature source are given for each CMC value and an indication of the apparent quality of the preparation and method used are included. A shorter table gives selected values which are believed to be particularly reliable, including highly accurate ones. Among these, concordant values from at least two independent laboratories are emphasized. Included in the introduction is a general discussion of the importance and significance of CMC values and of methods for their determination, as well as a summary of the procedures used in the collection, evaluation and presentation of these values. Extensive indexes are provided.
Author

N71-26754* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AUTOMATED FLUID CHEMICAL ANALYZER Patent
James R. Clark, Gerard A. Soffen, Jerry L. Stuart, and Joon H. Rho, inventors (to NASA) Issued 2 Feb. 1971 55 p Filed 14 Mar. 1968 Cl. 23-253; Int. Cl. G01n31/00, 33/16 Sponsored by NASA
(NASA-Case-XNP-09451; US-Patent-3,560,161; US-Patent-Appl-SN-713162) Avail: US Patent Office CSCL 07D

A fully automated fluid chemical analyzer is described which includes at least one analyzer unit for performing an analysis of a fluid-reagent mixture and generating an electrical signal proportional to the quantity of a selected constituent in the fluid. The apparatus is operated and controlled by an electronic logic and sequencer circuit which drives valve motors to connect a selector and a control valve in each analyzer unit to the fluid. The solutions needed for the analysis and the drive motors and timing mechanisms necessary for automated operation are self contained within the apparatus. A data handling system is also included for receiving and processing the electrical signals produced by the analyzer units. Each analyzer unit contains a device such as calorimeter or fluorometer for performing the actual analysis and generating the electrical signal. The analysis is performed after the pH of the fluid being analyzed has been adjusted by the apparatus to from 0.1 to 1. Official Gazette of the U.S. Patent Office

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N71-25685# Lincoln Lab., Mass. Inst. of Tech., Lexington.
EARTH COVERAGE (FOOTPRINT) OF A SATELLITE-BORNE ANTENNA
Stephen L. Zolnay Feb. 1971 18 p
(Contract F19628-70-C-0230)
(AD-719763; TN-1971-7; ESD-TR-71-12) Avail: NTIS CSCL 9/5

An exact solution is given to the problem of the intersection of an arbitrarily oriented cone and a sphere for the application of finding the Earth coverage - footprint - of a narrow beam satellite borne antenna. Two cases are considered: when the pointing angles from the satellite are known, and when the coordinates of the point on the Earth toward which the boresight is aimed are known. The situation of partial coverage is also treated in detail. Examples are included to illustrate the method Author (GRA)

N71-25763# Helsinki Univ. (Finland). Radio Lab.
TRANSMISSION QUALITY IN WEAKLY INHOMOGENEOUS TEM-TRANSMISSION LINES, PART 1
Seppo J. Halme 1971 23 p
(S-37-1971-Pt-1) Avail: NTIS

Wave propagation is analyzed using normal mode development for deterministic and stochastic inhomogeneities. The characteristics of the transmission and reflection are evaluated assuming Gaussian statistics in line inhomogeneities. Author (ESRO)

N71-25778# Joint Publications Research Service, Washington, D.C.
RADIO LINE FOR SHORT RANGE COMMUNICATIONS IN THE MILLIMETER BAND
V. G. Timoshenko 27 Apr. 1971 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radioelektron. (Ukrainia SSR), v. 14, no. 1, 1971 p 34–39
(JPRS-52977) Avail: NTIS

A broadband radio line for short wave communications on frequencies characterized by an intensive absorption of the radio beam by atmospheric oxygen is described. The basic merits of such a radio line are: (1) a high degree of transmission security, (2) interference resistance, and (3) functions under all weather conditions.
Author

N71-25848# Mitre Corp., Bedford, Mass.
Kth ORDER NEAR ORTHOGONAL CODES
Irving S. Reed Mar. 1971 19 p refs
(Contract F19628-68-C-0365)
(AD-720822; MTP-115; ESD-TR-71-78) Avail: NTIS CSCL 9/4

Certain near-orthogonal codes have recently been used in multiple-short keying communication systems. The codes generally considered for this application are the first order Reed–Solomon RS codes. The purpose of this paper is to extend this class of codes. It is shown that codes can be developed with the property that no two members of the code overlap in more than K frequency-time slots. It is also shown that certain subsets of these codes are synchronizable. The optimum kth order near-orthogonal synchronizable codes are certain subsets of RS codes with a maximum distance d = n-k, where n is the number of code symbols.
Author (GRA)

N71-25870# Technology, Inc., Dayton, Ohio.
AN IMPROVED DOPPLER TRACKING SYSTEM (IDTS)
Barrett L. Myers, John H. Stebel, and Joseph A. Cali Dec. 1970 237 p refs
(Contract F33657-70-D-0279)
(AD-720832) Avail: NTIS CSCL 9/2

The effort involves a study/analysis of the feasibility of an improved doppler tracking system (IDTS), as well as recommendations for equipment needed for a working system. The primary emphasis of the task was the analysis and selection of the best minicomputer for the IDTS. The report enumerates the requirements of an IDTS which would be capable of data acquisition and on-site analysis of doppler tracking data. The report also includes many reference articles explaining various evaluation criteria for choosing a minicomputer and several tabulations comparing popular computer parameters. Author (GRA)

N71-28913*# Stanford Univ., Calif. Inst. for Plasma Research.
MODE COUPLING CONDITIONS IN THE IONOSPHERE

FOR SOLAR RAYS RECEIVED AT STANFORD
P. C. W. Fung and Y. C. Chin July 1970 13 p refs
(Grant NGL-05-020-014; Contract F44620-69-C-0008)
(NASA-CR-118640; AD-716614; AFOSR-70-2700-TR; SU-PR-337) Avail: NTIS CSCL 03B

The radio waves from the sun observed at ground base have to pass through two media; the corona and the ionosphere. Since both media are inhomogeneous, the effects of magnetoionic mode coupling on the variation of polarization properties of propagating electromagnetic radiation can be significant. By means of ray tracing technique, it can be shown that when the frequency of the radio waves is not close to the appropriate plasma level, the ray is almost a straight line. The discussions presented pertain to frequencies of this category. Author

N71-28920*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIO FREQUENCY UTILIZATION IN THE BANDS OF PRINCIPAL INTEREST FOR AERONAUTICAL SATELLITES
John J. Bisaga, Earl J. Holliman, and Allan Schneider Dec. 1970 128 p refs
(NASA-TM-X-65527; X-490-70-447) Avail: NTIS CSCL 17B

Radio frequencies examined are those allocated and assigned in the frequency bands 118.0 to 136.0 MHz (VHF) and 1535 to 1660 MHz (UHF or L band). The frequency areas were considered as possible candidates for aeronautical communications using satellite techniques because of their current allocation to the aeronautical service. The present utilization, future trends which would affect frequency availability with projected growth, and pertinent factors influencing frequency assignment for the time frame to 1980 were studied. Since the ability to meet increased utilization also depends upon channelization and performance characteristics, the parametric relation of these factors for a range of values were included. Author

N71-28005# Office of Naval Research, London (England).
DETECTION OF SAMPLED SIGNALS
Richard O. Rowlands 22 Feb. 1971 11 p refs
(AD-720805; ONRL-R-6-71) Avail: NTIS CSCL 9/4

It is shown that a signal whose frequency spectrum is symmetrical in amplitude but not necessarily in phase about the midband frequency has a narrower ambiguity function in the time domain than one whose amplitude spectrum is asymmetric. It is also shown that if the sampling frequency is in quadrature with the midband frequency near the point when the envelope reaches its peak value, at least two other samples will be obtained whose amplitudes are no more than 4 dB below this peak value. Author (GRA)

N71-28068# Helsinki Univ. (Finland). Radio Lab.
OPTIMUM ESTIMATION OF CONTINUOUS TARGET DISTRIBUTIONS
Seppo J. Halme 7 Jan. 1971 14 p refs
(S-38-1971) Avail: NTIS

Using statistical theory optimum estimation of a continuous target distribution density is analyzed. Gaussian target distribution statistics are assumed. MAP (maximum aposteriori probability) and MLE (maximum likelihood estimate) estimates are derived, and their variances are calculated. Optimum signal design is discussed. Author (ESRO)

N71-28101* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HIGH IMPACT ANTENNA Patent
Kenneth E. Woo, inventor (to NASA) Issued 13 Oct. 1970 5 p Filed 30 Jan. 1968 Cl. 343-786; Int. Cl. H01Q13/02 Sponsored by NASA
(NASA-Case-NPO-10231; US-Patent-3,534,376; US-Patent-Appl-SN-701767) Avail: US Patent Office CSCL 17B

A high impact antenna is disclosed which consists of a cup, whose open end defines the antenna's radiating aperture. A probe, which is energized with microwave energy, is positioned within the cup, parallel to the cup's shorted end at a selected distance therefrom and at an angle with respect to the cup's side walls to excite modes therein, which radiate outwardly through the open end at a selected polarization. Dielectric material fills the cup to support the probe, as well as strengthen the side walls from collapsing, when the antenna is subjected to high impact. The dielectric material serves to keep foreign matter out of the antenna and enables the construction of an antenna of reduced size. Official Gazette of the U.S. Patent Office

N71-28102* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIDEO COMMUNICATION SYSTEM AND APPARATUS Patent
Henry Canvel, inventor (to NASA) Issued 21 Oct. 1969 9 p Filed 9 Nov. 1966 Cl. 178-6.6; Int. Cl. H04n5/76 Sponsored by NASA
(NASA-Case-XNP-06611; NASA-Case-XNP-09830; US-Patent-3,474,192; US-Patent-Appl-SN-593607) Avail: US Patent Office CSCL 17H

A real time line-by-line half tone printer for maintaining a slow scan video communication system is described. The system includes multiplicity of displacable type faces, each face having a cluster of a predetermined plurality of ordered uniform half tone printing protusions, an operable worksheet platen, and a type control mechanism connected within the video communication system. The printer is adapted to drive the printing members and platen in a manner such that as a selected scene is viewed by an associated video system, the video output signals are employed by the control mechanism to drive the printing members and the platen for achieving line-by-line printing of order clusters of half tone dots. The scene is reproduced by a multiplicity of nonuniform clusters of half tone dots which are uniformly spaced. Official Gazette of the U.S. Patent Office

N71-28104# Naval Postgraduate School, Monterey, Calif.
THEORY AND PERFORMANCE OF A MATCHED-FILTER DOPPLER DIRECTION-FINDING SYSTEM
Henry Orejuela and Glen A. Myers Sep. 1970 183 p refs
(AD-720699; NPS-52MV70091A) Avail: NTIS CSCL 17/3

A new radio direction-finding (DF) technique which applies matched-filter theory to the DF problem is presented. The new technique, called Matched-Filter Doppler Direction Finding (MFD DF) is based on the doppler DF principle in which a rotating antenna, or its equivalent, superimposes periodic frequency modulation on the received carrier. The phase of the induced modulation contains information on the angle of arrival. It is shown that a bandpass filtering operation, which satisfies the phase-matching requirement of a matched filter, converts the frequency-modulated signal to an amplitude-modulated signal whose envelope is a periodic narrow pulse with no sidelobes. The relative time of occurrence of the pulse is a measure of angle of arrival. Included is the description of and results obtained with an experimental system used to confirm the analytical results, to study the effects of noise, and to explore alternatives available in the design of an operating system. Encouraging results were obtained using this same experimental system with a conventional operating doppler DF set. Author (GRA)

N71-28140# Radio Corp. of America, Princeton, N.J. Astro Electronics Div.
VLF EXPENDABLE TRANSMITTER Final Report, 16 Jun. 1969 - 28 Apr. 1970
Richard W. Crossett 12 May 1970 66 p
(Contract F19628-69-C-0282)
(AD-720268; AED-R-3585F; AFCRL-71-0057) Avail: NTIS CSCL 17/2

The effort demonstrated the feasibility of a solid-state VLF transmitter, in a moderate size package, that is capable of generating 4 kilowatts of power output. The report contains a technical description of the circuits used in the feasibility model transmitter, and describes its operation and its testing approach. It presents the test results and provides details of certain components used in the transmitter for which data may not be readily available. The transmitter is capable of supplying 4 kilowatts of output power for 1 hour, operating on a 50 percent duty cycle. The weight of the unit, including the battery, is 130 pounds and it measures 24 x 18 x 16 inches. The transmitter was successfully tested over a -60 to +100F range and at pressures equivalent to 45,000 feet altitude to ground ambient pressure. Although the transmitter proved feasibility of the concept, additional effort is recommended in investigation, trade-off analysis, and design to optimize the configuration with regard to packaging and component selection.
Author (GRA)

N71-26141# Air Force Cambridge Research Labs., Bedford, Mass.
HOBB'S FAILSAFE DECODER
Charles F. Hobbs, Stanwood Ayer, Joseph P. Brazy, and Lawrence V. Kriger 7 Jan. 1971 31 p refs *Its* Phys. Sci. Res. Papers No. 442
(AD-720250; AFCRL-71-0028) Avail: NTIS CSCL 9/4

To improve the reliability of digital communications systems, an encoder/decoder was designed, constructed, and evaluated for failsafe and error correction capabilities under stationary gaussian noise conditions. It employs a random error-correcting (73,45) cyclic code in a binary erasure channel. The code is in the class of difference set cyclic codes. Discussed are trade-offs between failsafe communication and efficiency of transmission rate. Also discussed is a special threshold detection technique for error correction purposes. Included is a brief description of the experimental system and the procedures used for computer evaluation.
Author (GRA)

N71-26150# Research Inst. of National Defence, Sundbyberg (Sweden).
ANTENNA FOR SPEECH COMMUNICATION SET FPL37 MEASUREMENTS OF IMPEDANCE ON THE PRODUCTION VERSION IN LIGHT METAL [TALKOMMUNIKATIONSANTENN TILL FPL 37. IMPEDANSMAETNINGAR PA SERIEVERSION I LAETTMETALL]
Viggo Westerlin Oct. 1969 8 p refs In SWEDISH
(FOA-3-C-3602-61) Avail: NTIS

The earlier antenna put forward has undergone certain alterations in changing to the production version made in light metal. The report briefly reviews impedance measurements for the new design. Desirable alterations of the basic design are stated.
Author

N71-26175# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
TARGET DETECTION AND ACQUISITION DEVICES Final Report
14 Jan. 1971 27 p refs
(AD-720569; MTP-6-3-037) Avail: NTIS CSCL 17/5

Procedures are described for the evaluation of airborne target detection and acquisition systems.
Author (GRA)

N71-26176# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
COMMUNICATION, SURVEILLANCE AND AVIONIC ELECTRONIC EQUIPMENT Final Report
4 Jan. 1971 35 p refs
(AD-720577; MTP-6-4-003) Avail: NTIS CSCL 17/2

Worldwide operations of the Army require that communication-electronic equipment be capable of performing in a humid tropic environment. Subsequent to testing in temperature climates and simulated environments, field testing is conducted. The document describes the procedures for conducting the field tests in the actual tropic environment.
Author (GRA)

N71-26180# Harry Diamond Labs., Washington, D.C.
A TIMING GENERATOR FOR ELECTRONICALLY SCANNED RADAR SYSTEMS
Michael J. Katz and Ronald J. Reyzer Mar. 1971 55 p
(AD-720533; HDL-TM-70-28) Avail: NTIS CSCL 9/1

Circuitry to generate the timing marks in an electronically scanned radar system is described. The circuitry consists essentially of two shift registers located with the video processing (ground) electronics, and one shift register located with the antenna array. One of the ground shift registers provides signals to interrogate each of the range sample and hold circuits in each azimuth sector. The second shift register selects the azimuth sector to be interrogated. The shift register at the antenna array is synchronized with this second shift register and, through a decoder, selects the particular dipoles of the antenna array that radiate to form the radar beam for that azimuth sector. A breadboard version of the system was constructed. It has an effective antenna-rotation rate of 1.4 kHz, and is applicable to surveillance radar and air-traffic ground-approach installations.
Author (GRA)

N71-26181* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
AUDIO SIGNAL PROCESSOR Patent
Robert L. Hymer, inventor (to NASA) Issued 12 Jan. 1971 5 p Filed 8 Jul. 1969 Cl. 179-1; Int. Cl. H04b15/00
(NASA-Case-MSC-12223-1; US-Patent-3,555,192; US-Patent-Appl-SN-839941) Avail: US Patent Office CSCL 17B

The output signal from a microphone is fed through a preamplifier to a variable attenuator and then to an automatic volume control (AVC) circuit. A voice operated switch is connected between the output of the microphone preamp and the attenuator and activates the latter when the output signal from the preamp falls below a predetermined minimum amplitude to introduce signal attenuation at the same rate as gain is increased in the automatic volume control circuit. Induced noise surges are thus eliminated during periods of silence or low amplitude input into the microphone.
Official Gazette of the U.S. Patent Office

N71-26248 Southern Methodist Univ., Dallas, Tex.
A STUDY OF DOUBLE SIDED INTERSYMBOL INTERFERENCE IN DIGITAL DATA COMMUNICATION SYSTEMS
Neil Martin Schmitt (Ph.D. Thesis) 1969 141 p
Avail: Univ. Microfilms Order No. 70-13224

Two methods by which the effects of double sided intersymbol interference (DSISI) can be eliminated or reduced in modern digital data communication systems are investigated. These methods are applied to an actual physical system employing a magnetic disc file as the magnetic storage device. Error rate curves are calculated in each case and the performance of each system is compared with the other as well as to the optimum performance determined by investigation of the isolated bit communication system (DSISI is not present). These detection procedures can accommodate bit densities greater than 3000 BPI.
Dissert. Abstr.

N71-26272*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATIONS OF TWO-DIMENSIONAL INTEGRAL EQUATION THEORY TO REFLECTOR ANTENNA ANALYSIS
W. V. T. Rusch 15 May 1971 117 p refs
(Contract NAS7-100)
(NASA-CR-118522; JPL-TM-33-478) Avail: NTIS CSCL 09E

The Method of Moments is applied to the solution of integral equations for the current induced on conducting cylinders immersed in an arbitrary two-dimensional field. The solution is outlined and such scattering parameters as the induced-field ratio and the extinction cross section are defined. Numerical solutions are obtained for several geometries which are relevant to the problem of large reflector antenna analysis. Author

N71-26280# Defense Documentation Center, Alexandria, Va.
RADAR AND RADAR DETECTION SYSTEMS: RADOMES, VOLUME 1 Bibliography Report, Apr. 1961 – Dec. 1969
Mar. 1971 153 p refs
(AD-720200; DDC-TAS-70-81-1-Vol-1) Avail: NTIS CSCL 17/9

The bibliography is Volume I of a two-volume set on Radomes in a series on Radar and Radar Detection Systems. It contains 107 annotated entries which express the use of composite materials, ceramic materials, textiles and plastics in Radomes. Discussed in the volume are design, construction, manufacturing methods, stresses, wave transmission and performance evaluation of Radomes. Corporate author-monitoring agency, subject, title and personal author indexes are included. Author (GRA)

N71-26291* Massachusetts Inst. of Tech., Cambridge.
OPTICAL FREQUENCY WAVEGUIDE Patent
Charles H. Townes, Raymond Y. Chiao, and Elsa M. Garmire, inventors (to NASA) Issued 19 Jan. 1971 8 p Filed 11 Oct. 1965 Cl. 350-96; Int. Cl. G02b5/14 Sponsored by NASA
(NASA-Case-HQN-10541; US-Patent-3,556,634; US-Patent-Appl-SN-494739) Avail: US Patent Office CSCL 17B

An optical frequency electromagnetic beam is maintained at a power level such that electrostrictive qualities of a selected medium are altered. This is causing the beam to generate its own waveguide, for directing energy through such medium. Official Gazette of the U.S. Patent Office

N71-26292* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
VALIDATION DEVICE FOR SPACECRAFT CHECKOUT EQUIPMENT Patent
Herbert E. Cribb, inventor (to NASA) Issued 5 Jan. 1971 5 p Filed 9 Apr. 1968 Cl. 325-67; Int. Cl. H04b7/18
(NASA-Case-XKS-10543; US-Patent-3,553,586; US-Patent-Appl-SN-719870) Avail: US Patent Office CSCL 17B

A device for validating the equipment used for checking out the C-band system on a spacecraft prior to flight is described. The device simulates the C-band equipment on the spacecraft. Hence, when the checkout equipment is connected to the device, it can be determined whether or not the checkout equipment is in proper working condition. Also the device provides means for making very shortwave radio and attenuation measurements. Official Gazette of the U.S. Patent Office

N71-26338*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROPAGATION OF LONG WAVES IN CURVED DUCTS
Wojciech Rostafinski (Ph.D. Thesis – Catholic Univ. of Louvain, Belgium) Apr. 1970 124 p refs
(NASA-TM-X-67184) Avail: NTIS CSCL 20N

The propagation of long waves in a two dimensional system is analysed. An acoustic approximation is used and boundary conditions simulating typical industrial piping systems are formulated. A general solution of the boundary value problem is outlined. Series solutions of the equations of motion are generated, and a physical interpretation of results is given. A numerical application and a discussion of the problem are included. Author

N71-26362*# Radio Corp. of America, Camden, N.J. Communications Systems Div.
DESIGN, FABRICATION, DEVELOPMENT AND TEST OF A SATELLITE VIDEO RECORDER/REPRODUCER Quarterly Report, 1 Feb. – 30 Nov. 1970
30 Nov. 1970 225 p refs
(Contracts NAS5-11643; NAS5-11288)
(NASA-CR-118667; QR-5) Avail: NTIS CSCL 14C

Continuing efforts are reported directed towards the final design of the video recorder/reproducer. Two technical modifications were incorporated into the design including: (1) implementation of the capability to record and reproduce multi-spectral scanner information, and (2) a redesign of the command structure required in the ERTS recorder necessitating a major change in the command/control circuitry. A thorough description is included of all technical areas that were effected by the changes. The results of performance tests and evaluations of the modified equipment are presented. In addition, design descriptions are given for three bench test equipments and six ground station recorders which were added to the development program. D.L.G.

N71-26375# Technische Hogeschool, Eindhoven (Netherlands).
ELECTRONIC IMAGE MOTION COMPENSATION IN A PORTABLE TELEVISION CAMERA
D. J. A. Teuling (Ph.D. Thesis) [1970] 24 p refs
(TH-70-E-13) Avail: NTIS

Motion pictures from vehicle-mounted or hand-held television cameras often suffer from unacceptable vibrations, mainly due to camera pitch and yaw motions. With the aid of two camera-mounted angular accelerometers, a signal can be obtained, that makes the scanning beam in the camera tube follow the image displacements on the target. A steady monitor picture despite camera jiggle is obtained. Author

N71-26533# Forsvarets Forskningsanstalt, Stockholm (Sweden). Avdelning 3.
EQUIPMENT FOR EXPERIMENTAL STUDY OF COMMUNICATION VIA METEOR TRACK [UTRUSTNING FOER EXPERIMENTELLT STADIUM AV METEORSPARFOERBINDELSE]
Benny Johansson and Krister Gunmar Nov. 1969 51 p In SWEDISH
(FOA-3-C-3597-63) Avail: NTIS

An apparatus for the experimental study of communication via a meteor track and the background to radio communications via reflecting meteor tracks are described. The transmission which is modulated by a binary sequence of numbers in 31 bits provides a narrow band frequency shift signal at about 85 MHz. The receiving apparatus also houses the frequency shifting and the detection synchronizing elements for this type of intermittant data transmission. Finally a description is given on how the laboratory data computer LINC-8 is used for on-line operation with signals received from the transmitter. Author

N71-26534# Forsvarets Forskningsanstalt, Stockholm (Sweden). Avdelning 3.
AKSA-UHF CONNECTION WITH AUTOMATIC CHOICE OF CHANNEL AND SELECTIVE CALLING [AKSA-UK-SAMBAND MED AUTOMATISKT KANALVAL OCH SELEKTIVT ANROP]
Kjell Jonasson and Bertil Lindblad Nov. 1969 56 p refs In SWEDISH Supersedes FOA-3726-63
(FOA-3-A-3731-63) Avail: NTIS

A UHF connection system with automatic choice of channel and selective calling up is described that can serve any sort of composite unit collected within an area whose size is limited only by the range of the apparatus. Author

N71-26542# Forsvarets Forskningsanstalt, Stockholm (Sweden). Avdelning 3.
DESCRIPTION OF EQUIPMENT FOR COMMUNICATION BY TROPOSPHERIC PROPAGATION [BESKRIVNING OEVER UTRUSTNING FOER TROPOSFAERSPRIDNINGSFOERBINDELSE]
Oerjan Carlson Oct. 1969 25 p refs In SWEDISH
(FOA-3-C-3804-63) Avail: NTIS

The main components in a tropospheric propagation link are described. Detailed descriptions of how the installation performs are given. The report serves particularly as the basis for handling the equipment. Author

N71-26575 Cornell Univ., Ithaca, N.Y.
JOINT OPTIMIZATION OF TRANSMITTING AND RECEIVING FILTERS
Edward H. Jocoy (Ph.D. Thesis) 1969 132 p
Avail: Univ. Microfilms Order No. 70-11233

The joint optimization of a pair of linear, time-invariant, transmitting (or pre) and receiving (or post) filters is examined in continuous and discrete time domains. The filters, operating over an additive noise channel, are optimized using a mean-square error (m.s.e.) criterion subject to a transmitted power constraint. All random processes are considered stationary with signal and noise uncorrelated. The nonlinear necessary equations for the optimum filter pair are solved in closed form for infinite observation intervals of the received signal yielding optimum transfer functions of the infinite-lag filter pair. For finite observation intervals, a digital computer provided finite-memory filter solutions to the necessary equations in the discrete time domain. In both the case of a pre- and post-filter and a post-filter alone, the memory lengths required to achieve significant reduction in m.s.e. were surprisingly low. Dissert. Abstr.

N71-26579* Hughes Aircraft Co., Los Angeles, Calif.
NARROW BANDWIDTH VIDEO Patent
Walter H. Bockwoldt, inventor (to NASA) Issued 30 Sep. 1969 24 p Filed 13 May 1966 Cl. 178-6; Int. Cl. H04n7/12 Sponsored by NASA
(NASA-Case-XMS-06740-1; US-Patent-3,470,313; US-Patent-Appl-SN-554277) Avail: US Patent Office CSCL 09E

This is a television system in which the video signal is sampled for recording on separate tracks of a magnetic storage means to form a plurality of low resolution spatially interrelated video frames. When the tracks of video information are played back in time-base synchronism, the video information contained is interlaced horizontally and vertically to provide high resolution video information. In addition, the number of tracks of low resolution video information played back at any instant of time can be selectively controlled and the background brightness level can be controlled. Official Gazette of the U.S. Patent Office

N71-26581# Joint Publications Research Service, Washington, D.C.
EXPERIMENT ON RECEPTION OF SHORT RADIO WAVES AT A MAGNETOCONJUGATE POINT
Ye. A. Benediktov et al 19 May 1971 9 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 11, no. 2, 1971 p 252–257
(JPRS-53168) Avail: NTIS

The results are given of reception of short radio waves at a point magnetoconjugate to the City of Gor'kiy. The experiment was carried out in October 1968. Receiving equipment was on the scientific research vessel' Borovichi and the transmitter in the City of Gor'kiy. Signals were recorded with delays of from 40 to 110 milliseconds corresponding to a group path of the radio waves of from 12,000 to 33,000 kilometers. Different possible signal propagation paths are discussed. Author

N71-26640# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHOSPHOR NOISES COMPENSATION IN A PROJECTION TUBE
A. M. Tyukanov et al 27 Jan. 1971 15 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (USSR), v. 14, no. 6, 1970 p 62–65
(AD-720751; FTD-MT-24-298-70) Avail: NTIS CSCL 17/2

An analysis and classification of phosphor noises was made. Defined is the dependence of phosphor noises compensation from the boundary frequency of video signal. Considered are some factors limiting the phosphor noises compensation by the feedback method. Conclusions are made about the possibility of using the given method for the image quality improvement. Author (GRA)

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics

N71-25719*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NEW DEVELOPMENTS IN CONVOLUTIONAL ENCODING AND DECODING
Thomas J. Lynch Apr. 1971 17 p refs Presented at NTG/IEEE Coding Conf., Brunswick, 7–9 Oct. 1970
(NASA-TM-X-65536; X-750-71-139) Avail: NTIS CSCL 09D

The historical development of convolutional encoding and decoding is outlined and a brief tutorial explanation of the convolutional coding concept is given. The recent progress in encoding and decoding is described by citing specific examples. In particular, in the decoding area, the application of such techniques as sequential decoding, threshold decoding, and maximum likelihood decoding is described. Some examples of actual communication systems that incorporate convolutional codes are given. Author

N71-25869*# Brown Univ., Providence, R.I.
COMPUTATION ON FINITE MACHINES
J. E. Savage [1971] 42 p refs
(Grant NGR-40-002-082; NSF GK-13162)
(NASA-CR-118636) Avail: NTIS CSCL 09B

A definition of the computing power of storage units is given and an exchange relation is established between the number of logic elements, cycles and bits of storage required to compute functions. Four principal results are that: (1) sequential storage can be exponentially less efficient than random access storage; (2) functions of more than modest relative complexity should be computed using random access storage; (3) tasks should be assigned to submachines in a computing system on the basis of the complexity of the associated functions and the work potential of the submachines; and (4) checking for the validity of programs requires an amount of computational work which is exponential in the maximal length of programs for most finite languages. Author

N71-25921*# Northrop Corp., Huntsville, Ala. Electro-Mechanical Div.
STATISTICAL ALGORITHMS AND COMPUTER PROGRAMS FOR ANALYSIS OF MULTI-SPECTRAL OBSERVATIONS Final Report
M. Y. Su, J. C. Pooley, and C. G. Hand Dec. 1970 176 p refs
(Contract NAS8-25182)
(NASA-CR-103182; TR-794-860) Avail: NTIS CSCL 09B

The use of change analysis methods for the classification of resolution elements in multispectral remote sensing data analysis

by pattern recognition is discussed. An algorithm based on a principle of inventory boundary enhancement which involves area smoothing and taking absolute value of the two directional difference of the smoothed data was developed as well as an algorithm based on the statistical variation of the multispectral data and the confidence limit of the statistical estimation. Computer programs are described which extend the automatic data flow compression and signature enhancement techniques for earth-based sensors to in-flight sensors. The computer programs are applied to multispectral scanner data taken from an aircraft over agricultural fields. J.M.

N71-25922*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

ASTRONAUT/COMPUTER COMMUNICATION STUDY Final Report

Mar. 1971 218 p refs

(Contract NAS8-25701)

(NASA-CR-103171; MDC-G0985) Avail: NTIS CSCL 09B

A detailed description is presented of the efforts performed and conclusions drawn from astronaut/computer interactions. The onboard crew functions that are performed or assisted by an onboard graphic display computer system were identified. Methods were devised by which space vehicle crewmen can communicate function requirements with the onboard computer via a graphic display device. A vocabulary structure conducive to crew/computer communication utilizing a graphic display computer system was formulated and demonstrated. Supporting data are appended. J.M.

N71-25930# Information and Communication Applications, Inc., Silver Spring, Md.

COMPUTER ARCHITECTURE STUDY Final Report, 15 Mar.–15 Oct. 1970

Forrest S. Keeler, Alain P. Grebert, and David A. Nelson Jan. 1970 169 p refs

(Contract F04701-70-C-0210)

(AD-720798; ICA-C-69-274-D/12; SAMSO-TR-70-420) Avail: NTIS CSCL 9/2

A proposed airborne computer architecture and organization is described. The approach taken was to develop an architecture which would directly execute computer programs written in the Space Programming Language without the usual time and cost handicap of higher-level language compilation. SPL was thoroughly analyzed and evaluated and a Space Programming Language Machine (SPLM) architecture was developed. The primary emphasis is on the SPLM design using a stack organizational approach rather than the traditional von Neumann-type computer organization. Secondary emphasis is placed on SPL itself with appropriate deletions, changes, and extensions outlined. Apparent and suspected cost advantages for the SPLM architecture approach as compared with traditional computer types are outlined. Recommendations for future Air Force action related to SPLM design and simulation are included. Author (GRA)

N71-25976# Gesellschaft fuer Informatik, Stuttgart (West Germany).

INFORMATION RETRIEVAL SYSTEMS (IRS) AND MANAGEMENT INFORMATION SYSTEMS (MIS) [INFORMATION RETRIEVAL SYSTEME (IRS) UND MANAGEMENT INFORMATION SYSTEME (MIS)]

1970 421 p refs Partly in GERMAN and partly in ENGLISH

Proc. of the Colloq. held at Stuttgart, 9 - 11 Dec. 1970

Avail: NTIS HC $6.00/MF $0.95

Conference papers are presented on problems in information retrieval and information systems, dealing with computer programming, syntax, and semantic problems in the construction of dictionaries, methods of data storage, decision making in information retrieval, analysis of query formulations, and pattern recognition for index extraction. For individual titles see N71-25977 14-08 through N71-25997 14-08). ESRO

N71-25977# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).

ON THE CONCEPT OF AN INFORMATION RETRIEVAL SYSTEM FOR FORMATTED FILES [ZUR KONZEPTION EINES INFORMATION RETRIEVAL SYSTEMS FUER FORMATIERTE DATEIEN]

J. Karlstorfer *In* Ges. fuer Informatik Inform. Retrieval Systems (IRS) and Management Inform. Systems (MIS) 1970 p 1–24 refs In GERMAN (See N71-25976 14-08)

Avail: NTIS HC $6.00/MF $0.95

A method is described to translate through an intermediate code and a table driven processor a retrieval question formulated in a user-oriented language. The individual tasks to be executed are detailed. The user-oriented language is of a simple structure. ESRO

N71-25978# Technische Hochschule Stuttgart (West Germany). Rechenzentrum.

A DATA DOCUMENTATION SYSTEM FOR LINKED FILES [EIN DATENDOKUMENTATIONSSYSTEM FUER EINEN VERBUND VON DATEIEN]

W. Dirlewanger, H.-J. Schneider, and C. Unger *In* Ges. fuer Informatik Inform. Retrieval Systems (IRS) and Management Inform. Systems (MIS) 1970 p 26–49 In GERMAN (See N71-25976 14-08)

Avail: NTIS HC $6.00/MF $0.95

A program is described to interrogate a file structure stored in a mass memory. The file structure and the routines available to update, change, or clear files are described. The syntax and semantics of the job and the search language are outlined. ESRO

N71-25979# Gesellschaft fuer Informatik, Stuttgart (West Germany).

SYNTAX ORIENTED DATA FORMATTING [SYNTAX-ORIENTIERTE DATENAUFBEREITUNG]

Peter Schnupp *In its* Inform. Retrieval Systems (IRS) and Management Inform. Systems (MIS) 1970 p 50–73 refs In GERMAN (See N71-25976 14-08)

Avail: NTIS HC $6.00/MF $0.95

The reformatting and significance analysis of files for the input into a data base must be based on an analysis of the syntax of the data files. For these tasks a syntax machine consisting of recognizers is described which is simulated in a TR86 machine. It is an example of table driven compilation. ESRO

N71-25980# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

A CONCEPT FOR QUICK RETRIEVAL OF NON-NUMERICAL DATA BY COMPUTERS [EIN KONZEPT ZUM SCHNELLEN WIEDERAUFFINDEN VON NICHTNUMERISCHEN DATEN DURCH RECHENANLAGEN]

Hans-Juergen Skronn *In* Ges. fuer Informatik Inform. Retrieval Systems (IRS) and Management Inform. Systems (MIS) 1970 p 74–82 In GERMAN (See N71-25976 14-08)

Avail: NTIS HC $6.00/MF $0.95

A method is described of storing an inverted file used in searching bibliographical data in high energy physics at DESY, Hamburg, Germany, with a minimum of storage space and low access times. ESRO

N71-25981# International Business Machines Corp., Hamburg (West Germany).

A METHOD FOR AUTOMATIC INDEXING, STORAGE, AND RETRIEVAL OF FULL-TEXT DOCUMENTS [EIN VERFAHREN ZUR AUTOMATISCHEN INDIZIERUNG, SPEICHERUNG UND WIEDERERBRINGUNG VON

VOLLTEXT-DOKUMENTEN]
H. Schuerfeld, M. P. Perriens, and F. Boehme *In* Ges. fuer Informatik Inform. Retrieval Systems (IRS) and Management Inform. Systems (MIS) 1970 p 83–100 refs In GERMAN (See N71-25976 14-08)
Avail: NTIS HC $6.00/MF $0.95

The IBM PSS (Patent Searching System) is described. It operates with automatic indexing using word truncation and similar query formulation in an on-line mode. ESRO

N71-25982# Bonn Univ. (West Germany). Inst. fuer Kommunikationsforschung.
SIMULATION OF VERBAL BEHAVIOR [SIMULATION VERBALEN VERHALTENS]
Guenther Billmeier *In* Ges. fuer Informatik Inform. Retrieval Systems (IRS) and Management Inform. Systems (MIS) 1970 p 102–106 In GERMAN (See N71-25976 14-08)
Avail: NTIS HC $6.00/MF $0.95

A computer program is described to simulate the generation of flected forms of irregular verbs in German. The number of 196 word stems is combined with 84 classes of flection. The system can be used both for composition of word sequences and for their parsing. ESRO

N71-25983# Bonn Univ. (West Germany). Inst. fuer Kommunikationsforschung.
FILE ORGANIZATION FOR A COMMUNICATIVELY CONTROLLED PROCESS [ZUR DATENORGANISATION EINES KOMMUNIKATIV GESTEUERTEN PROZESSES]
Timm Krumnack *In* Ges. fuer Informatik Inform. Retrieval Systems (IRS) and Management Inform. Systems (MIS) 1970 p 107–112 In GERMAN (See N71-25976 14-08)
Avail: NTIS HC $6.00/MF $0.95

The data structure of an interactive man-machine information retrieval system is described. A communicatively controlled processor is used to maintain a dialog between the user and the data file. ESRO

N71-25984# European Atomic Energy Community, Ispra (Italy).
SLC-2, A SOFTWARE FOR LINGUISTIC DATA PROCESSING [SLC-2, EINE SOFTWARE FUER LINGUISTISCHE DATENVERARBEITUNG]
Sergei Perschke *In* Ges. fuer Informatik Inform. Retrieval Systems (IRS) and Management Inform. Systems (MIS) 1970 p 127–146 refs In GERMAN (See N71-25976 14-08)
Avail: NTIS HC $6.00/MF $0.95

A computer program for the following tasks is described: input of non-analyzed text, significance analysis by dictionary searching, and processing of logical units of text (phrases, etc). The program is used to translate text from Russian into English. ESRO

N71-25985# European Atomic Energy Community, Ispra (Italy).
STRUCTURE AND WORKING OF AN AUTOMATIC DICTIONARY FOR AUTOMATIC INDEXING [AUFBAU UND FUNKTION DES AUTOMATISCHEN DIKTIONAERS BEI DER AUTOMATISCHEN SCHLAGWORTZUTEILUNG]
Hermann Fangmeyer *In* Ges. fuer Informatik Inform. Retrieval Systems (IRS) and Management Inform. Systems (MIS) 1970 p 147–160 refs In GERMAN (See N71-25976 14-08)
Avail: NTIS HC $6.00/MF $0.95

A dictionary for automatic keyword extraction from running text is described to be used within a programming language for processing free language text. The operations involved are text analysis and dictionary search. Automatic indexing is seen as automatic translation from natural language into a syntax-free artificial language. The searching vocabulary consists of truncated words from natural language. ESRO

N71-25986# Technion - Israel Inst. of Tech., Haifa.
EFFICIENT EXECUTION OF QUERIES OVER LARGE TREE-STRUCTURED DATA BASES
A. Reiter (Lockheed, Palo Alto, Calif.), A. Clute (Lockheed, Palo Alto, Calif.), and J. M. Tenenbaum (Lockheed, Palo Alto, Calif.) *In* Ges. fuer Informatik Inform. Retrieval Systems (IRS) and Management Inform. Systems (MIS) 1970 p 161–187 refs Sponsored by NSF (See N71-25976 14-08)
Avail: NTIS HC $6.00/MF $0.95

A question-answering system is described, operating in three phases: syntactic analysis of free text user questions, semantic analysis of questions, and retrieval, with particular stress on the third phase. The data description, the syntax of the retrieval language, and the execution of searches is discussed. ESRO

N71-25987# International Business Machines Corp., Sindelfingen (West Germany).
THE EXTERNAL STORAGE ORGANIZATION AS CLASSIFICATION PRINCIPLE FOR DISTINGUISHING INFORMATION SYSTEMS [DIE EXTERNE SPEICHERORGANISATION ALS EINTEILUNGSPRINZIP FUER DIE UNTERSCHEIDUNG VON INFORMATIONSSYSTEMEN]
G. Krieg *In* Ges. fuer Informatik Inform. Retrieval Systems (IRS) and Management Inform. Systems (MIS) 1970 p 189–200 In GERMAN (See N71-25976 14-08)
Avail: NTIS HC $6.00/MF $0.95

A description is given of the properties of information retrieval and management information systems. Data structure, hierarchy generation, and searching are discussed. ESRO

N71-25988# European Space Research Organization, Paris (France).
THE INDUCTIVE METHOD FOR THE AUTOMATIC PROCESSING OF FORMATTED AND NATURAL LANGUAGE. CONSTRUCTION OF THE TITLE WORD THESAURUS FOR THE NASA FILE [DIE INDUKTIVE METHODE IN DER AUTOMATISCHEN VERARBEITUNG FORMATIERTER UND NATUERLICHER SPRACHE. DER AUFBAU EINES TITELWORT-THESAURUS FUER DIE NASA-DATEI]
Ivo Steinacker and Gerd Muehlhauser *In* Ges. fuer Informatik Inform. Retrieval Systems (IRS) and Management Inform. Systems (MIS) 1970 p 201–239 refs In GERMAN (See N71-25976 14-08)
Avail: NTIS HC $6.00/MF $0.95

In order to extract significant expressions to be used as descriptors in the ESRO/ELDO Documentation System originating from NASA, a KWIC-like permutation is processed using principles of pattern recognition and pattern enhancement. ESRO

N71-25989# Stiftung Volkswagenwerk, Hannover (West Germany).
POSSIBILITIES AND LIMITS OF INFORMATION STORAGE AND RETRIEVAL METHODS ILLUSTRATED ON AN EXAMPLE IN THE FIELD OF SCIENCE PROMOTION [MOEGLICHKEITEN UND GRENZEN VON INFORMATIONSSPEICHERUNGS- UND WIEDERGEWINNUNGSVERFAHREN DARGESTELLT AN EINEM BEISPIEL AUS DEM BEREICH DER WISSENSCHAFTSFOERDERUNG]
Wolf Steinbach *In* Ges. fuer Informatik Inform. Retrieval Systems (IRS) and Management Inform. Systems (MIS) 1970 p 240–278 refs In GERMAN (See N71-25976 14-08)
Avail: NTIS HC $6.00/MF $0.95

The problem of knowledge transfer in sponsoring research is discussed with respect to the use of information retrieval systems. Existing information retrieval systems are characterized and compared, in particular the GOLEM system created by Siemens, Munich. ESRO

N71-25990# Gesellschaft fuer Informatik, Stuttgart (West Germany).
ELECTRONIC DATA PROCESSING TERM LISTINGS AS A BASIS FOR MIS AND IRS [EDV-BEGRIFFSLISTEN ALS VORAUSSETZUNG ZU MIS UND IRS]
Ulrich Bischoff *In its* Inform. Retrieval Systems (IRS) and Management Inform. Systems (MIS) 1970 p 280-287 In GERMAN (See N71-25976 14-08)
Avail: NTIS HC $6.00/MF $0.95

The compilation of dictionaries for information retrieval systems from the vocabularies used in different fields of science is discussed. Such vocabularies are collected from workers or institutions working in these fields and are then merged into one dictionary. This method is applied to administrative information storage systems. ESRO

N71-25991# International Business Machines Corp., Sindelfingen (West Germany).
INTEGRATION OF TEXT PROCESSING AND WRITTEN COMMUNICATION INTO A MANAGEMENT INFORMATION SYSTEM [DIE INTEGRATION DER TEXTVERARBEITUNG UND SCHRIFTLICHEN KOMMUNIKATION IN DAS INFORMATIONSSYSTEM DES UNTERNEHMENS]
Hans G. Duerr *In* Ges. fuer Informatik Inform. Retrieval Systems (IRS) and Management Inform. Systems (MIS) 1970 p 288-319 refs In GERMAN (See N71-25976 14-08)
Avail: NTIS HC $6.00/MF $0.95

The integration of a text processing system for internal and external communication in a company into a management information system is described. The use of automatic typewriters, primary magnetic storage, and secondary microfilm storage in an on-line operation is outlined. For retrieval purposes, a register must be established permitting searching for items of information in a dialog mode. ESRO

N71-25992# Freie Univ., Berlin (West Germany).
THE INFORMATION SYSTEM AS SUBJECT OF INFORMATION SCIENCES AND INFORMATICS [DAS INFORMATIONSSYSTEM ALS GEGENSTAND DER INFORMATIONSWISSENSCHAFTEN UND DER INFORMATIK]
G. Wersig *In* Ges. fuer Informatik Inform. Retrieval Systems (IRS) and Management Inform. Systems (MIS) 1970 p 321-329 In GERMAN (See N71-25976 14-08)
Avail: NTIS HC $6.00/MF $0.95

The terminological difference and the boundaries of "informatics and information sciences is discussed. The relationship between the information sciences and the traditional science disciplines is made clear. It appears that the information sciences and computer science overlap only as regards the use of computers in the accomplishment of practical processes. ESRO

N71-25993# Mathematischer Berstungs- und Programmierungsdienst G.m.b.H., Dortmund (West Germany).
INCREASING DATA SEARCH SYSTEM FOR SMALL AND MEDIUM COMPUTERS [EIN ANFRAGESYSTEM UEBER WACHSENDE DATENMENGEN FUER KLEINE UND MITTLERE DATENVERARBEITUNGSANLAGEN]
Horst H. Schmidt *In* Ges. fuer Informatik Inform. Retrieval Systems (IRS) and Management Inform. Systems (MIS) 1970 p 330-363 ref In GERMAN (See N71-25976 14-08)
Avail: NTIS HC $6.00/MF $0.95

Strategies for searching in databank files which are adapted to both the query and the file structure are described. Data are not formatted. The compilation and the structure of the thesaurus is outlined, and the files are represented as a set of network structures. ESRO

N71-25994# Bonn Univ. (West Germany). Inst. fuer Kommunikationsforschung.
DEVELOPMENT OF A DYNAMIC INFORMATION SYSTEM [UEBER DIE ENTWICKLUNG EINES DYNAMISCHEN INFORMATIONSSYSTEMS]
D. Krallmann *In* Ges. fuer Informatik Inform. Retrieval Systems (IRS) and Management Inform. Systems (MIS) 1970 p 364-370 In GERMAN (See N71-25976 14-08)
Avail: NTIS HC $6.00/MF $0.95

The dictionary used to communicate in an information retrieval system should, by dynamically adaptive methods, keep up with new developments. Words of a dictionary were segmented to obtain the component elements forming the units of a semantic network. ESRO

N71-25995# European Atomic Energy Community, Luxembourg.
THE EUROPEAN NUCLEAR DOCUMENTATION SYSTEM (ENDS) [DAS EUROPAEISCHE NUKLEAR-DOKUMENTATIONSSYSTEM (ENDS)]
C. Vernimb *In* Ges. fuer Informatik Inform. Retrieval Systems (IRS) and Management Inform. Systems (MIS) 1970 p 371-388 In GERMAN (See N71-25976 14-08)
Avail: NTIS HC $6.00/MF $0.95

The automatic documentation system of EURATOM is described. For input, which proceeds from abstract journals, the problem of eliminating duplication is discussed and means of suppressing overlap are shown. The structure of the thesaurus is outlined, retrieval strategies are described, and the system performance evaluation based on user feedback is discussed. ESRO

N71-25996# Koln Univ. (West Germany). Inst. fuer Betriebswirtschaftslehre.
REMARKS OF STATE OF APPLICATION AND DEVELOPMENT OF COMPUTERIZED INFORMATION SYSTEMS IN SELECTED US FIRMS [THESEN ZUM ANWENDUNGSSTAND UND ZUR ANWENDUNGSENTWICKLUNG COMPUTERGESTUETZTER INFORMATIONSSYSTEME IN AUSGEWAEHLTEN US-UNTERNEHMUNGEN]
N. Szyperski, F. Meller, and H. Roelle *In* Ges. fuer Informatik Inform. Retrieval Systems (IRS) and Management Inform. Systems (MIS) 1970 p 389-403 In GERMAN (See N71-25976 14-08)
Avail: NTIS HC $6.00/MF $0.95

The performance characteristics of management information systems and of their use in US industry are evaluated. The requirements for such systems are outlined, and suggestions are offered to improve their performance and utilization. ESRO

N71-25997# Studiengruppe fuer Systemforschung, Heidelberg (West Germany).
DEVELOPMENT OF AN INFORMATION SYSTEM FOR THE FEDERAL DIET [DIE ENTWICKLUNG EINES INFORMATIONSSYSTEMS FUER DEN DEUTSCHEN BUNDESTAG]
W. Kunz, K.-H. Meyer-Uhlenried, and H. Rittel *In* Ges. fuer Informatik Inform. Retrieval Systems (IRS) and Management Inform. Systems (MIS) 1970 p 404-417 In GERMAN (See N71-25976 14-08)
Avail: NTIS HC $6.00/MF $0.95

The design of a management information system for the German Government is outlined. Data acquisition, user needs, law documentation, and microfilm storage of full length documents are discussed. ESRO

N71-25998 Infotech, Ltd., Maidenhead (England).
THE FOURTH GENERATION: INTERNATIONAL

COMPUTER STATE OF THE ART REPORT
Ian S. Hugo, ed. 1971 507 p refs Conf. held in [1971]
Copyright. Avail: Datamation Magazine, 35 Mason St., Greenwich, Conn. 06830 CSCL 09B

Papers and discussions are presented on developments to be expected or hoped for in the computing industry over the next few years. Details are given on the design for computers and associated equipment, system configuration, operating systems, languages and compilers, software engineering, and user considerations. N.E.N.

N71-26306# Cornell Univ., Ithaca, N.Y. Dept. of Computer Science.
INFORMATION STORAGE AND RETRIEVAL: PROJECT SMART Scientific Report to the National Science Foundation and to the National Library of Medicine
Oct. 1970 523 p refs
(PB-188957; ISR-18) Copyright. Avail: NTIS HC $6.00/MF $0.95 CSCL 05B

Research in automatic information storage and retrieval is discussed. Subjects presented are: (1) automatic content analysis, (2) automatic dictionary construction, (3) user feedback procedures, (Sections VIII to XI), (4) document and query clustering methods, and (5) systems design for on-line operations. Author

N71-26330# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.
PARAMETER ADJUSTMENT BY THE GRADIENT METHOD ON THE HYBRID ANALOG COMPUTER [DIE PARAMETERANPASSUNG DURCH DAS GRADIENTENVERFAHREN AUF DEM HYBRIDEN ANALOGRECHNER]
F. Katz Sep. 1970 45 p refs In GERMAN
(NP-18646) Avail: AEC Depository Libraries

The development of modern analog computers facilitates new iterative computing techniques, which enable the use of an analog computer to deal with many problems which so far could not be solved or only with great difficulty. To this class of problems belongs also the treatment of optimization problems. The applicability of the gradient method as an optimization strategy for use with analog computers is shown. In addition, the method is applied to a particular problem which arises in fast reactor core structure design, and the usefulness of the method is investigated in detail. Author (NSA)

N71-26343*# Brown Univ., Providence, R.I.
THE COMPLEXITY OF DETERMINISTIC SOURCE ENCODING WITH A FIDELITY CRITERION
John E. Savage [1970] 16 p refs
(Grants NGR-40-002-082; NSF GK-13162)
(NASA-CR-118656) Avail: NTIS CSCL 09B

The problem of deterministic source encoding with a fidelity criterion is studied using a measure of computational work. A lower bound to the computational work required to encode with average distortion D is derived and the bound is shown to vary essentially inversely with the difference D − D sub R, where D sub R is the minimum distortion consistent with encoding rate R, given by the rate-distortion bound. The bound on work is shown to be reasonably tight at low encoding rates for binary sources and the Hamming distortion measure. At larger rates, no encoders are known which achieve the bound and in fact it is shown that most encoders require a work which is exponential in the lower bound. Author

N71-26361*# Michigan Univ., Ann Arbor. Systems Engineering Lab.
THEORY AND DESIGN OF RELIABLE SPACECRAFT DATA SYSTEMS
Sep. 1970 393 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952492)
(NASA-CR-118664) Avail: NTIS HC $6.00/MF $0.95 CSCL 09D

A study is reported of the theory and techniques applicable to the design, analysis, and fault diagnosis of reliable spacecraft data systems. The study was concerned primarily with the following three problems: (1) permanent memory faults in sequential machines and networks, (2) faults in combinatorial networks, and (3) fault diagnosis in machines and networks. A technical report and summary of separate investigations in each of the three areas are given. D.L.G.

N71-26381*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN INTEGRATOR DESIGN
Fred T. Krogh 15 May 1971 63 p refs
(Contract NAS7-100)
(NASA-CR-118521; JPL-TM-33-479) Avail: NTIS CSCL 09B

The general design of a system of subroutines for solving the initial value problem in ordinary differential equations is given. An attempt is made to design these subroutines in such a way that they will be easy to use on easy problems and still be flexible enough to treat any type of initial value problem with a high degree of efficiency. Emphasis is on the use of these subroutines, rather than on the mathematical algorithms which at this time are not completely specified. Implementation of the design in FORTRAN 4 suffers from deficiencies in the design of the multiple entry feature provided in some of the current FORTRAN 4 compilers. Author

N71-26412*# Miami Univ., Fla. Dept. of Industrial Engineering and Systems Analysis.
THE USE OF GERT IN PLANNING STRATEGIES FOR DEVELOPMENT TYPE PROJECTS
Joseph J. Moder 15 Jun. 1970 68 p refs
(Contract NAS12-2080)
(NASA-CR-118490) Avail: NTIS CSCL 09B

The use of GERT nomenclature to describe a project plan or system operating policy is considered. The advantages of using this approach in system analysis, and ultimately in communication were discussed. The addition of time estimates, cost, resource requirements, branching probabilities, and other parameters associated with the network activities are assessed for a management policy governing the handling of university inventions. The GERT nomenclature was compared with that of the restrictive logic of PERT/CPM and is shown to have more utility. E.H.W.

N71-26431# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
THE AGNOS LANGUAGE
R. Klement, W. Liles, M. Merritt, and A. Vreeland Apr. 1971 22 p
(Grants GM-16197-03; NSF GK-2716)
(TR-71-19) Avail: Issuing Activity

The IBM 360/44's operating system has been modified to permit the Adage to read and write on the IBM disk files without affecting the 360's current user. This foreground disk access permits the Adage System to handle many graphic application programs without recourse to the 360's computational facilities. This type of operation is called stand-alone programming. The lower cost of the Adage System and its greater accessibility are the major advantages of stand-alone programming. The major disadvantage is that, at present, the programs must be written in the ADEPT/360 machine symbolic language. ADEPT/360 requires a detailed knowledge of the Adage computer and peripheral devices. The AGNOS language was developed to allow IBM 360/44 FORTRAN programmers access to the Adage graphics facilities. AGNOS has two parts. One part resides in the 360 and interprets FORTRAN

calls to the graphic software, while the other part resides in the Adage, controlling the image processing and operating the interactive devices. Author

N71-26480# Joint Publications Research Service, Washington, D.C.

PROBLEMS OF PROGRAMMING (ALL-UNION CONFERENCE IN NOVOSIBIRSK)

A. P. Yershov *In its* Vestn. of the USSR Acad. of Sci., Vol. 40, No. 6, 1970 31 Aug. 1970 p 142–145 refs (See N71-26452 14-30)

Avail: NTIS

Papers presented during an international conference on problems in computer programming pertain to the development of time-sharing systems, the development of machine graphics, and improvements of technology and organization in mathematical servicing. G.G.

N71-26551# American Association of State Highway Officials, Washington, D.C.

PROCEEDINGS OF THE COMMITTEE ON COMPUTER TECHNOLOGY NATIONAL CONFERENCE

May 1970 395 p refs Conf. held at Albany, N.Y., 27–28 May 1970

Avail: Issuing Activity

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11. COMPUTER GRAPHICS IN THE BUREAU OF PUBLIC ROADS J. S. Smith (Bureau of Public Roads, Washington, D.C.) p 379–386 (See N71-26562 14-08)

12. DATA PLOTTING REQUIREMENTS W. N. Lofroos (Florida Dept. of Transportation, Tallahassee) p 387–399 (See N71-26563 14-08)

N71-26552# Connecticut Dept. of Transportation, Wethersfield. Bureau of Planning and Research.

A GENERAL TRAFFIC FLOW SIMULATION MODEL FOR FREEWAY OPERATION

Stewart Leland and F. E. Coleman *In* Am. Assoc. of State Highway Offic. Proc. of the Comm. on Computer Technol. Natl. Conf. May 1970 p 9–66 refs (See N71-26551 14-08)

Avail: Issuing Activity

The objectives of the Connecticut computer simulation model for vehicle flow on freeways are described. The modelling concepts, computer program logic, and a case to corroborate the model validation are presented. It was shown that the model can duplicate the important stream characteristics that indicate the level of service and operational characteristics of a geometric design. It is concluded that the model logic is sound and is expected to perform adequately in the analysis of any geometric designs. Author

N71-26553# Pennsylvania Dept. of Highways, Harrisburg. Bureau of Management Information Systems.

PENNSYLVANIA'S MATERIALS AND EQUIPMENT INVENTORY SYSTEM

George S. Eakin *In* Am. Assoc. of State Highway Offic. Proc. of the Comm. on Computer Technol. Natl. Conf. May 1970 p 67–105 (See N71-26551 14-08)

Avail: Issuing Activity

The computerized inventory control system for the highway department of Pennsylvania is described. The computer assumes the responsibility for (1) maintaining stock levels, (2) reordering, (3) monitoring consumption by counties, and (4) providing necessary reporting. The procedures for daily on-line processing of valid warehouse and management analyst transactions are described. Each transaction is saved on a history file which may be used for manual backup in case of computer failure. The inventory control of field stockpiled winter service materials is considered the most difficult aspect of the system. F.O.S.

N71-26554# Wisconsin Dept. of Transportation, Madison.

HIGHWAY NETWORK DATA AND INFORMATION SYSTEM (HNDI)

Gilbert Brumm *In* Am. Assoc. of State Highway Offic. Proc. of the Comm. on Computer Technol. Natl. Conf. May 1970 p 106–145 refs (See N71-26551 14-08)

Avail: Issuing Activity

The highway integrated operation system (IOS) of Wisconsin is presented. It consists of subsystems which include the functions of major decision making, management and technical services. The general concept of the computer system for the IOS is described and is based on processing, storing and displaying data for all public roads in Wisconsin. The input and output processes are discussed along with data flow. F.O.S.

N71-26555# New York State Office of Planning Coordination, Albany. Bureau of Planning Research.

NEW YORK'S PLANNING INFORMATION SYSTEM

Donald Croteau *In* Am. Assoc. of State Highway Offic. Proc. of the Comm. on Computer Technol. Natl. Conf. May 1970 p 146–154 (See N71-26551 14-08)

Avail: Issuing Activity

A formal system for the interchange of information among state agencies is discussed for coordinating systems which support program management, planning, budgeting, and involve interagency responsibility for collection, management, and dissemination of data. A multipurpose geographical data base of hierarchical structure is described which is composed of the county inquiry system, the minor civil division profile system, and the plan map and data list processing system. The communication gap between the decision maker and the data processing technician is also discussed. F.O.S.

N71-26556# Texas Highway Dept., Austin.

THE ROAD DESIGN SEGMENT OF TIES

Larry G. Walker and S. E. Mangum *In* Am. Assoc. of State Highway Offic. Proc. of the Comm. on Computer Technol. Natl. Conf. May 1970 p 155 - 186 (See N71-26551 14-08)
Avail: Issuing Activity

The Road Design segment of TIES is described as an integrated system of almost 200 computer processes developed to aid engineers in the design of highways. These computer engineering applications are placed at the designer's disposal to be used in any combination or sequence to achieve the desired results. All of these processes work with an integrated data base which serves the function of data transfer between processes. It also serves as a project file for road design and as a contributor to an overall master project file. The scope and capabilities of the initial version of the road design system are summarized, and some ways the subsystem might be used on a typical project are indicated. Its significant features are emphasized. Author

N71-26557# New York State Dept. of Transportation, Albany.
THE BRIDGE DESIGN SEGMENT OF TIES (PILOT STUDY)
Edward V. Hourigan *In* Am. Assoc. of State Highway Offic. Proc. of the Comm. on Computer Technol. Natl. Conf. May 1970 p 187-282 (See N71-26551 14-08)
Avail: Issuing Activity

A prototype integrated bridge design subsystem was developed to solve computational problems and generate necessary parameters for plotting. The programs were designed within the frame work of TIES, or on a stand-alone basis. Plot programs include: general plan of bridge, framing plan, transverse section, beam and girder schedules, abutment details, pier details, and slab bar plan for straight bridges. It is concluded that the prototype system has proven the feasibility of the systems approach to bridge design. F.O.S.

N71-26558# Bureau of Public Roads, Washington, D.C. Engineering Systems Div.
INTEGRATION OF DESIGN SUBSYSTEM OF TIES
James R. Link *In* Am. Assoc. of State Highway Offic. Proc. of the Comm. on Computer Technol. Natl. Conf. May 1970 p 283-295 (See N71-26551 14-08)
Avail: Issuing Activity

A pilot system of integrated design programs was studied in terms of software compatibility for TIES. A subset for procedure oriented language, FORTRAN, programming, and documentation techniques were devised as standards to be adopted by all state computer services for effective data interchange. Plans are being made for extensive tests of the TIES programs. F.O.S.

N71-26559# Kentucky Dept. of Highways, Frankfort. Bridge Div.
PRECONSTRUCTION PROJECT STATUS
John C. Bridwell *In* Am. Assoc. of State Highway Offic. Proc. of the Comm. on Computer Technol. Natl. Conf. May 1970 p 296-308 (See N71-26551 14-08)
Avail: Issuing Activity

The status of preconstruction highway projects for Kentucky are listed to provide design managers a base for making decisions regarding project priorities and delay factors. The monthly cycle of reporting activities and the management decision required are shown. A delay report is required when a project: becomes 20 percent shy of scheduled percentage of completeness; becomes 60 days behind on a critical milestone; remains 60 days behind for three consecutive months; and delay may be averted by some action or decision. It is concluded that the preconstruction project status system has been of benefit to department managers in readying highways for public use. F.O.S.

N71-26560# Kansas State Univ., Manhattan.
COMPUTER GRAPHICS AND THE RIBBON OF ROADWAY
Bob L. Smith *In* Am. Assoc. of State Highway Offic. Proc. of the Comm. on Computer Technol. Natl. Conf. May 1970 p 309-330 refs (See N71-26551 14-08)
Avail: Issuing Activity

Research in the visual quality of the highway ribbon is reported with emphasis on the short sag vertical curve. The curves with a grade change of two percent are considered the most valid, as there is no apparent reason for small grade changes. The coordination of horizontal and vertical curves to present a visually smooth-flowing alignment is discussed, and several perspective drawings of various combinations are included. It is concluded that spiral curves improve the appearance of circular curves, and the rate at which a curve appears to diverge from the tangent affects the visual quality. F.O.S.

N71-26561# Montana State Highway Commission, Helena. Data Processing Div.
PERSPECTIVE PLOTTING VIA ELECTRONIC COMPUTER
James W. Sawyer *In* Am. Assoc. of State Highway Offic. Proc. of the Comm. on Computer Technol. Natl. Conf. May 1970 p 331-378 (See N71-26551 14-08)
Avail: Issuing Activity

A perspective highway viewing program was developed to aid in the design of safe and comfortable roads. A sample subroutine is described, and the basic items in its use are: (1) describing the object to be plotted with three space coordinates at the essential points; (2) initializing that particular viewing technique, and (3) commanding the plotter which points to connect in what sequence and what type of line. It is concluded that the computer provides and abstraction that needs additional information from the landscape artist. F.O.S.

N71-26562# Bureau of Public Roads, Washington, D.C. Engineering Systems Div.
COMPUTER GRAPHICS IN THE BUREAU OF PUBLIC ROADS
J. Stanley Smith *In* Am. Assoc. of State Highway Offic. Proc. of the Comm. on Computer Technol. Natl. Conf. May 1970 p 379-386 (See N71-26551 14-08)
Avail: Issuing Activity

The use of computer graphics is studied for the production of computer program input forms, and highway perspectives. The advantages of automated form preparation are: decrease in time, higher quality, and uniformity. The basic steps in the development of computer generated perspective images, and animation are discussed. F.O.S.

N71-26563# Florida Dept. of Transportation, Tallahassee.
DATA PLOTTING REQUIREMENTS
W. N. Lofroos *In* Am. Assoc. of State Highway Offic. Proc. of the Comm. on Computer Technol. Natl. Conf. May 1970 p 387-399 (See N71-26551 14-08)
Avail: Issuing Activity

A system of evaluating the requirements for data plotting equipment for the Florida transportation department is presented. Equipment specification and description formats are included. A detailed cost analysis of each system proposed is also required. F.O.S.

N71-26643*# Boeing Co., Houston, Tex.
THE VIPS ADDRESSABLE INTERFACE UNIT Final Report
Dale A. Haskenson 5 Apr. 1971 122 p
(Contract NAS9-9347)
(NASA-CR-114997; Rept-5-2934-HOU-290) Avail: NTIS CSCL 09D

An addressable interface was designed, installed and tested in GRE 1. The interface provides the necessary logic circuitry to permit control and monitoring of GRE functions by a digital

computer. The hardware produced consisted of interface circuits installed in GRE 1 and two cards of digital logic circuits, one for the GRE and one for the IBM 2701 interface. In developing the GRE interface, a generalized addressable interface was developed which is extendable to all of the computer and peripheral equipment in the Visual Information Processing System. Specifically, the concepts developed were the command and data bus format, the line driver/receiver party line interconnection of the interface cards, the power distribution and grounding plan, and the initial layout of the packaging cards and the card file chassis. Author

N71-28727# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Kernphysik.

MESPRO66: THE OPERATION SYSTEM OF THE INTEGRATED DOUBLE COMPUTER INSTALLATION MIDAS OF FR2. PROGRAM DESCRIPTION

Gisela Wuerz Nov. 1969 33 p refs In GERMAN

(NP-18562) Avail: AEC Depository Libraries

The double computer system MIDAS installed at the nuclear research reactor FR2 in Karlsruhe controls the acquisition, processing and storing of the measuring data of 8 independent nuclear experiments in realtime. The experimenter controls the experimental process by command panels and display units. The processed data and in some cases the raw data are recorded onto magnetic tape. All experiments connected to MIDAS are measuring several parameters in many channels. Therefore, a special analyzing program using disk memory was developed which performs the on line acquisition of 256K channels. Hardware and software of MIDAS were extended by steps. The system has been in continuous operation since 1963. The operating system MESPRO66 which was designed for the double computer system is described. Author (NSA)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N71-28653# Technical Univ. of Denmark, Lyngby. Lab. of Electromagnetic Theory.

BACKFIRE ANTENNAS Final Scientific Report, 1 Jul. 1967 - 31 Aug. 1970

Erik Drago Nielsen 20 Sep. 1970 50 p refs

(Contract F61052-67-C-0056)

(AD-719879; S183-R81; AFCRL-70-0662) Avail: NTIS CSCL 9/5

The research was restricted to surface wave structures consisting of dipole elements, especially the Yagi antenna structure. Two different ways of approach were investigated. In the first method, usual array theory was employed, the mutual impedances between the dipole elements were calculated according to the EMF method, and the radiation due to the presence of a large surface wave reflector of finite extent was determined from the surface current distribution on the plate. The second method is based on Harringtons Method of Moments, which is a theory for setting up a matrix solution to the problem by subdividing the whole antenna into small segments, over which a constant current may be assumed. Numerical results for Yagi backfire antennas and short-backfire antennas were compared with experimental results obtained in the Radio Anechoic Chamber, Technical University of Denmark. Author (GRA)

N71-28654# Innsbruck Univ. (Austria).

ANTENNAS FOR THE VLF REGION AND LF REGION

Richard Klein 15 Aug. 1970 46 p refs

(Contract F61052-69-C-0007)

(AD-719875; AFCRL-70-0802; SR-4) Avail: NTIS CSCL 9/5

A description is given of all the transmitting and receiving antennas that have been used for VLF project studies. The antenna efficiency is discussed and helical transmitting antennas are described in a special chapter. Various diagrams plotted in accordance with the described antenna measurements are given. Author (GRA)

N71-28696# Naval Underwater Systems Center, New London, Conn.

SOURCE LOCATION WITH AN ADAPTIVE ANTENNA ARRAY

Norman L. Owsley 6 Jan. 1971 35 p refs

(AD-719896; NUSC/NL-3015) Avail: NTIS CSCL 9/5

An adaptive antenna array processing technique that allows a spatial signal field to be characterized in terms of multiple wavefronts in a background of spatially uncorrelated noise is presented. In particular, the array processor would provide simultaneous, real time, multisource positional location. The technique is interpreted in terms of an eigenvector decomposition of the single-frequency, spatial-correlation matrix of the data received at the spatial array of sensors. A relationship is established between a multiple wavefront signal field and the eigenvectors of the corresponding single-frequency, sensor-to-sensor, correlation matrix. Because of the orthogonality of the correlation matrix eigenvectors, the processor gives an interference-rejection capability that is useful when locating weak signal sources in the presence of strong interfering sources. Finally, an iterative-adaptive algorithm for the real-time implementation of the array processor is specified. Author (GRA)

N71-28717# Joint Publications Research Service, Washington, D.C.

TECHNOLOGICAL PROCESS SYNTHESIS IN THE MANUFACTURE OF INTEGRATED CIRCUITS

L. N. Kolesov 7 May 1971 17 p refs Transl. into ENGLISH from Izv. Vuzov SSSR, Radioelektron. (Kiev), v. 14, no. 2, Feb. 1971 p 123-134

(JPRS-53078) Avail: NTIS

Formalized schematics of manufacturing process in the production of integrated circuits are examined and a schematic of manufacturing operators is evolved. Concept of the scale of schematic of manufacturing operators is introduced, and principles of a step-by-step and optimal synthesis of this schematic are stated. A practical method of matrix synthesis of the schematic is suggested. Author

N71-28866* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

TRANSIENT VIDEO SIGNAL RECORDING WITH EXPANDED PLAYBACK Patent

Ronald C. Sander and Ronald J. Hruby, inventors (to NASA) Issued 22 Dec. 1970 9 p Filed 1 Apr. 1968 Cl. 178-66; Cl. 179-100.2; Int. Cl. H04n1/28; Int. Cl. G11b27/38

(NASA-Case-ARC-10003-1; US-Patent-3,549,799; US-Patent-Appl-SN-717822) Avail: US Patent Office CSCL 09C

A transient video signal is recorded on a video recorder by triggering the recording circuits upon appearance of the transient and when the recorder is in the stop-motion mode. The recorded signal, or a selected portion, is subsequently reproduced for display on a cathode ray tube and for reproduction on an expanded time scale for a plotting device and/or an analog to digital converter. Official Gazette of the U.S. Patent Office

N71-28931*# Watkins-Johnson Co., Palo Alto, Calif.

DEVELOPMENT OF A 25 - 50 WATT HIGH EFFICIENCY,

X-BAND, TRAVELING WAVE TUBE Quarterly Report, Nov. 1970–Jan. 1971
Lester A. Roberts and Richard I. Knight Jan. 1971 18 p Prepared for JPL
(Contracts NAS7-100; JPL-952931)
(NASA-CR-118415; QR-2) Avail: NTIS CSCL 09C

The electron gun design was carried out using the computer design technique. The gun was then constructed and tested for beam trajectory and perveance in the beam testing system. Impedance match design and testing was completed for the coax to helix transitions. Subassembly construction was carried out to the point where a tube could be assembled. The PPM focusing structure was built and tested with platinum colbalt magnets. Author

N71-25939# Technical Univ. of Denmark, Lyngby. Lab. of Electromagnetic Theory.
INFLUENCE OF VARIATION OF BACKFIRE ANTENNA PARAMETERS. 1: YAGI BACKFIRE ANTENNA
Erik Drago Nielsen 1 Sep. 1970 37 p refs
(Contract F61052-67-C-0056)
(AD-719880; R80; AFCRL-70-0661; SR-2) Avail: NTIS CSCL 9/5

A large number of numerical results for Yagi backfire antennas are presented, from which the influence of a variation of the antenna parameters may be deducted. The results were obtained by means of a previously described theory for backfire antennas with dipole elements, and the numerical computations were carried out on a digital computer. Samples of the numerical results were compared with experimental results obtained in a radio anechoic chamber. Finally, the influence of small changes in the general Yagi backfire antenna structure, such as changing the single dipole reflector elements into a half-transparent or solid conducting plate or changing the array of equally long dipole director elements into a tapered array, was investigated. Author (GRA)

N71-25947# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
NOISE IN JOSEPHSON JUNCTION AMPLIFIERS
H. Choe Feb. 1971 75 p refs
(Contract N00014-67-A-0113-0010)
(AD-720385; TR-1) Avail: NTIS CSCL 9/5

A Josephson junction amplifier working at cryogenic temperature based on Josephson effect was studied and a prototype amplifier at 30 MHz carrier frequency was made. The noise performance of the amplifier was poorer than expected because of the multiple quantum transition oscillations. The noise power per unit bandwidth S sub v sub N (f) of this amplifier is proportional to N (a) where N is quantum transition number alpha is measured to be about 2.77. The noise level of this amplifier was calibrated by an f.m. noise calibration method. The input noise voltage per unit bandwidth square root of S sub v sub N (f) is typically 0.5 × 10 to the minus 9th power volt/square root of Hz at N 1000 and 30 MHz carrier frequency, which is better than the best transistor amplifier presently available. The sensitivity may be improved considerably by going to a higher carrier frequency and a more careful design of the junction and the system. Author (GRA)

N71-25999* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIRECT CURRENT MOTOR WITH STATIONARY ARMATURE AND FIELD Patent
Philip A. Studer, inventor (to NASA) Issued 9 Mar. 1971 10 p Filed 20 Aug. 1968 Cl. 318-138; Cl. 310-168; Cl. 318-254; Cl. 310-254; Int. Cl. H02k29/00
(NASA-Case-XGS-05290; US-Patent-3,569,804; US-Patent-Appl-SN-754019) Avail: US Patent Office CSCL 09A

A direct current (DC) motor structure having stationary (immovable) field and armature windings is described. A rotor formed of a material having high magnetic permeability and having salient poles is mounted adjacent to the field winding so that the field winding electromagnetically induces magnetic flux in the poles. The armature windings are also mounted adjacent to the rotor. In operation, the magnetic flux induced in the poles interacts with the current passing through the armature windings. The current flow in the armature windings is controlled by a solid-state commutator in a manner normally associated with brushless DC motors. By controlling the magnitude of the current supplied to the field windings, the speed of the motor is controlled. In addition, the windings can be connected in a series, shunt or compound configuration as desired. Official Gazette of the U.S. Patent Office

N71-26000* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CURRENT STEERING SWITCH Patent
Lawrence J. Zottarelli, inventor (to NASA) Issued 9 Sep. 1969 9 p Filed 17 May 1967 Cl. 307-88; Int. Cl. H02j1/10, 3/10
Sponsored by NASA
(NASA-Case-XNP-08567; US-Patent-3,466,459; US-Patent-Appl-SN-640783) Avail: US Patent Office CSCL 09A

A multistage current steering switch employing magnetic cores is described. Each stage includes an output core and a plurality of logic cores. All the output cores are inductively coupled in series by a first activating winding, while all the logic cores are inductively coupled by a second activating winding. Similarly, each output core is inductively coupled in series by a first control winding, with one logic core of each stage, while a second control winding inductively couples each output core to all the logic cores of its respective stage. An activating pulse drives one of the output cores to the magnetic state of the other cores, inducing a current in the first control winding which tends to switch all the logic cores. However, currents in inhibit windings inhibit all but one logic core from switching. That single core is again switched by a current in the second activating winding, inducing a current in the second control winding which causes the output core to be switched. Official Gazette of the U.S. Patent Office

N71-26001# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TRANSMITTING AND RECEIVING TELEVISION TUBES
A. P. Nefedev et al 28 Dec. 1970 20 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (Moscow), v. 14, no. 6, 1970 p 43–49
(AD-720380; FTD-MT-24-296-70) Avail: NTIS CSCL 17/2

As is known, level television technology essentially depends on light-signal and signal-light converts, in other words, on cathode-ray tubes CRT. These instruments determine the most important illumination and several other characteristics of a television device and the possible directions of its use. The development of television can represent a movement upward on the levels of a staircase, moreover transition to the next level becomes possible thanks to the use of new CRT. The image iconoscope created in its time opened the way for artistic television transmissions, the image orthicon made it possible to extend the transmitting camera beyond the limits of the studio, and the appearance of the vidicon opened the era of television reporting and applied television. In exactly the same manner that the creation of kinescopes with a screen of satisfactory sizes facilitated to the greatest degree the accomplishment of broadcast television transmissions in reality, so the introduction of color television will depend on the technical-economics indexes of color kinescopes. Author (GRA)

N71-26002* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PLATED ELECTRODES Patent
Benjamin Mosier, inventor (to NASA) Issued 23 Sep. 1969 3 p

Filed 5 Jan. 1967 Cl. 128-2.1; Int. Cl. A61b5/04
(NASA-Case-XMS-04213-1; US-Patent-3,468,303;
US-Patent-Appl-SN-607484) Avail: US Patent Office CSCL 09A

A silver electrode is described which is electrolytically plated with a metallic halogen salt and includes in the electrolytic solution a hydrophilic gelatin colloid whereby a selective ion screen is formed on the surface and in the electrode which permits the passage of metallic ions in communicating bioelectrical signals to the electrode but which blocks large protein molecules typically found in perspiration and which tend to poison the electrode by causing nonreversible chemical changes.

Official Gazette of the U.S. Patent Office

N71-28017# Teledyne MEC, Palo Alto, Calif. Lincoln Lab., Mass. Inst. of Tech., Lexington.

DEVELOPMENT AND FABRICATION OF MATCHED LONGITUDINAL ACOUSTIC WAVE TRANSDUCERS Final Report, 11 Jan. 1969 – 31 May 1970

W. Sperry and T. Reeder Dec. 1970 35 p refs Prepared for Lincoln Lab.
(Contract AF 19(628)-5167)
(AD-720820; ESD-TR-70-429) Avail: NTIS CSCL 9/1

The design and fabrication of a matched pair of 4 microsec. wide bandwidth delay devices is described with operation over a 500 MHz bandwidth centered at 1.7 GHz. Design techniques are discussed which allow relatively low insertion loss (35 dB) with extremely flat frequency response (plus or minus 0.5 dB) and superior TTS (above 45 dB). The magnitude of transmission phase ripple relative to linear phase is considered both theoretically and experimentally. Construction in a constant-temperature oven for phase-stable operation is described. The characteristics of devices obtained in quantity production are estimated. Author (GRA)

N71-28092* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

DUAL POLARITY FULL WAVE dc MOTOR DRIVE Patent

Michael F. Hanna, inventor (to NASA) Issued 17 Mar. 1970 4 p Filed 27 Dec. 1966 Cl. 318-258; Int. Cl. H02p3/12 Sponsored by NASA
(NASA-Case-XNP-7477; US-Patent-3,501,684;
US-Patent-Appl-SN-605098) Avail: US Patent Office CSCL 09A

A solid state braking circuit for use with a dc reversible motor of the type which is rotatable in either of two directions, as a function of the polarity of a dc potential across its input terminals is discussed. The motor is breakable by substantially shorting its input terminals, by the provision of a low resistance path. The braking circuit comprises four conventional diodes connected in a bridge arrangement, having four junction points. Two of the junction points are directly connected to the two input terminals of the motor, while a SCR diode is connected across the other two junction points. By providing an enabling control signal to the control input terminals of the SCR a low resistance path is provided across the SCR and between the input terminals of the motor. Four SCR's connected in a different bridge arrangement for switching the polarity and controlling the amplitude of the potential applied to the input terminals from a potential source are also disclosed

Official Gazette of the U.S. Patent Office

N71-28133* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

STORAGE CONTAINER FOR ELECTRONIC DEVICES Patent

George L. Filip, inventor (to NASA) Issued 20 Apr. 1971 5 p Filed 20 Jun. 1969 Cl. 317-101; Cl, 339-17; Int. Cl. H05k1/04
(NASA-Case-MFS-20075; US-Patent-3,575,638;
US-Patent-Appl-SN-835059) Avail: US Patent Office CSCL 09E

A sealed storage container for channel carriers having miniature electronic components mounted thereon is described. The container includes a base and a cover, and the base has several groups of three closely spaced slots cut therein; each group of slots receiving a channel carrier. Each slot has a spring conductor mounted therein that includes an elongated member terminating at one end in a point and at the other end in a tab. The spring conductor has a post extending from about the middle thereof that passes through the base and is soldered to one of a number of printed circuit paths on the outside of the base. The printed circuit paths extend to one side of the base member to form a male plug portion that makes it possible to plug the storage container into an instrument and perform electrical tests on the component.

Official Gazette of the U.S. Patent Office

N71-28182* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

ELECTRON BEAM TUBE CONTAINING A MULTIPLE CATHODE ARRAY EMPLOYING INDEXING MEANS FOR CATHODE SUBSTITUTION Patent

Lloyd J. Derr, inventor (to NASA) Issued 9 Feb. 1971 8 p Filed 9 Sep. 1969 Cl. 313-238; Cl. 313-237; Cl. 60-23; Int. Cl. H01j9/02 Sponsored by NASA
(NASA-Case-NPO-10625; US-Patent-3,562,575;
US-Patent-Appl-SN-856415) Avail: US Patent Office CSCL 09A

An indexing mechanism for an electron beam tube having many electron guns arranged on a turret is described which rotates the turret to replace the gun being used when it fails, and to rotate the turret to serially activate the cathodes of the guns during construction of the tube. One indexing apparatus employs an indexing wheel fixed to the turret, a stack of bimetallic washers, and a heater for making the washers buckle to move a pawl member toward the indexing wheel to advance it. Another indexing apparatus includes an indexing wheel fixed to the turret, a thermal motor that can rotate a shaft, a latch arm on the shaft that pivots out of engagement with the indexing wheel during the first few degrees of shaft rotation, and a pair of driving members that rotate the wheel after the latch arm disengages from it.

Official Gazette of the U.S. Patent Office

N71-28273*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

ELECTRIC SPACE POTENTIAL IN A CESIUM THERMIONIC DIODE

K. Shimada and W. Cannon 31 Mar. 1971 19 p refs
(Contract NAS7-100)
(NASA-CR-118519; JPL-TM-33-480) Avail: NTIS CSCL 09A

To investigate cesium plasma parameters that are required for a minimum plasma-loss operation of thermionic converters, a metal-ceramic device equipped with a movable Langmuir probe was constructed. The probe characteristics were examined for four different modes of cesium discharge including: (1) extinguished mode, (2) anode glow mode, (3) ball-of-fire mode, and (4) plasma mode to determine the space potentials and the electron energies in the plasma. The process of cesium ionization that is influenced strongly by the electric potential gradient is being studied to yield a minimum plasma-loss operation. Author

N71-26382 Texas A&M Univ., College Station.

AN ANALYSIS OF THE RADIATION CHARACTERISTICS OF ASYMMETRICALLY-DRIVEN, THIN LINEAR ANTENNAS

Joseph Henry Pierluissi (Ph.D. Thesis) 1969 114 p
Avail: Univ. Microfilms Order No. 70-11571

A study is made of the radiation characteristics of the thin, linear antenna of arbitrary length and driving point location. The vector potential method is used in the derivation. It is shown how the inclusion of this field explains an asymmetry observed on the measured patterns for the asymmetrically driven, linear antennas. The radiation patterns measured on antennas of various thicknesses indicate that the field-quadrature component of the far field can be ignored for all practical purposes if the ratio of the antenna half length to its radius is larger than about 200. The measurements also show that the asymmetry increases with increasing antenna

thickness. The driving point resistance of the asymmetrically driven, thin linear antenna is computed using the Poynting-vector method and the resulting integrals are evaluated using a digital computer. The results obtained show that the driving point resistance varies significantly as the driving point is moved from the center to a free end of this antenna. Dissert. Abstr.

N71-26413 Wisconsin Univ., Madison.
SPEED-TORQUE CONTROL OF THE CYCLOCONVERTER DRIVEN DOUBLY FED INDUCTION MOTOR
Willis Franklin Long (Ph.D. Thesis) 1970 127 p
Avail: Univ. Microfilms Order No. 70-8306

The purpose of this investigation was to establish the foundation for the development of an improved variable speed commutatorless electric machine drive system, with speed-torque characteristics suitable for applications ranging from multiunit industrial drive systems to vehicle propulsion systems. The result was a successful prototype system containing the following subsystems: (1) a doubly fed polyphase wound rotor induction motor, stator and rotor series connected, used as the electromechanical energy converter because of its higher power handling capability; (2) a rotor position sensor, capable of supplying a three phase signal which uniquely specifies rotor position at all speeds (including standstill), used as the stabilizing component by virtue of maintaining an essentially constant spatial displacement between stator mmf and rotor mmf; and (3) a three phase half wave cycloconverter, with a 400 Hz, 220 volt input supply, used to provide voltage to the motor at a frequency, phase, and amplitude specified by the rotor position sensor. Dissert. Abstr.

N71-26437 Wisconsin Univ., Madison.
GENERALIZED THEORY OF ASYNCHRONOUS MMF HARMONICS IN INDUCTION MACHINES
James Harley Davis (Ph.D. Thesis) 1970 250 p
Avail: Univ. Microfilms Order No. 70-8275

The prediction of the performance of squirrel cage induction machines with nonsinusoidal mmf distributions is discussed. The situations considered include winding connections which can produce both odd and even harmonic orders of mmf. Primary emphasis is on concentric wound two phase machines but the theory is not restricted to this configuration. A generalized theory is developed using a direct Fourier expansion of the turns distribution of the windings. Matrix methods are employed with matrix transformations used to provide the necessary equation manipulations. The final steady state equations describe some new types of equivalent circuits for which computer solutions are easily developed. Parameters for circuit computations are obtained by scaling a set of parameters derived by standard methods assuming only a fundamental mmf exists. Theoretical predictions are compared with experimental results. Experimental-theoretical correlations are made for normal windings and consequent pole windings. Dissert. Abstr.

N71-26532# Forsvarets Forskningsanstalt, Stockholm (Sweden). Avdelning 2.
MEASURING EMF IN A ROTATING, LOADED DIRECT CURRENT MOTOR [MAETNING AV EMK I ROTERANDE BELASTAD LIKSTROEMSMOTOR]
C.-A. Bruno and M. Wager Nov. 1969 34 p In SWEDISH
(FOA-2-C-2353-54) Avail: NTIS

The accuracy of a method to measure EMF in the pulse interval of a motor supplied by pulsed direct current is studied. Examined is an electrical measuring technique for guidance and control circuits of electrically guided hand prostheses. Author

N71-26547 Cornell Univ., Ithaca, N.Y.
GAIN BANDWIDTH PROPERTIES OF DISTRIBUTED PARAMETER LOADS
Robert Alan Friedenson (Ph.D. Thesis) 1969 148 p
Avail: Univ. Microfilms Order No. 70-11228

The gain bandwidth restrictions are considered for distributed parameter loads consisting of a resistor shunted by either an open circuited stub, a short circuited stub, or a combination of stubs which produces a second order zero of transmission. For the open circuited and short circuited stub loads aperiodic solutions for the optimum flat gain response are obtained by using a digital computer algorithm, which solves the infinite set of simultaneous constraint equations associated with the infinite number of periodically spaced load transmission zeros. It is shown that these solutions converge to the largest gain bandwidth product when only the fundamental frequency band is permitted and all higher order periodicities are properly suppressed by progressively shifting the center frequency of the higher order passbands, as their gains are attenuated or their bandwidths decreased. Furthermore, a new result for optimum flat gain periodic response is obtained for the open circuited stub case. Dissert. Abstr.

N71-26548# Danish Research Centre for Applied Electronics, Copenhagen.
THICK FILM TECHNOLOGY. 2: CONTACT PROBLEMS BETWEEN CONDUCTOR AND RESISTOR PASTES. DIP TINNING OF CONDUCTOR AREAS. OPTIMIZATION OF TERMINAL PULL STRENGTH [TYKFILMTEKNIK. 2: KONTAKTPROBLEMER MELLEM LEDER- OG MODSTANDSPASTA. DYPPEFORTINNING AF LEDERBANER. OPTIMERING AF TERMINALTRAEKSTYRKE]
S. T. Olesen Mar. 1971 111 p In DANISH; ENGLISH summary
Supported in part by Sammenslutningen for Palideligheds- og Miljoteknik and Philips Fond af 1958
(ECR-20) Avail: NTIS

Problems relating to choice of conductor materials and terminal processes in thickfilm circuits are reported. Contacts between conductor and resistor pastes, and a number of combinations of different fabrics and types of pastes are tested. The problems arising from dip-tinning are described and the importance of a number of parameters like firing, layer thickness, tin temperature, time, alloying, flux, and others are determined for a number of conductor materials. A process optimation of the terminal fastening by reflow-soldering is carried out with a view to maximum pull strength. The dependance of pull strength on ceramic type, conductor type, alloy, soldering process, layer thickness, and others is examined and the time stability of the pull strength at high operational temperatures is determined. Author

N71-26576 Florida Univ., Gainesville.
LOW FREQUENCY NOISE SOURCES IN BIPOLAR JUNCTION TRANSISTORS
Richard Charles Jaeger (Ph.D. Thesis) 1969 100 p
Avail: Univ. Microfilms Order No. 70-12242

An improved noise model is presented which includes three distinct excess noise sources. The importance of low frequency burst noise, has only been recognized recently since the advent of monolithic integrated circuits. Burst noise consists of sudden discrete shifts in the dc collector current of the transistor. The erratic behavior of this noise can severly impair the performance of high gain integrated amplifiers. The electrical behavior of burst noise is experimentally investigated and a phenomenological noise generator is developed. A transistor amplifier configuration utilizing two transistors and a dc current source is analyzed using this improved noise model. Both the analytical and experimental results show that this configuration is capable of dramatically reducing the effects of the low frequency noise sources of bipolar junction transistors. Dissert. Abstr.

N71-26594# Forsvarets Forskningsanstalt, Stockholm (Sweden).
EUROPEAN MEETING, SEMICONDUCTOR DEVICE

RESEARCH
Bertil Petersen Oct. 1969 14 p In SWEDISH; ENGLISH summary Conf. held at Munich, Mar. 1969
(FOA-3-C-3608-61) Avail: NTIS

Reported research covers microwave amplification and oscillation in semiconductors, semiconductor diodes and transistors, and ion implantation technology for semiconductors. Author

N71-26678* National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
FIELD IONIZATION ELECTRODES Patent
Alfred E. Barrington, Arthur L. Flores, and Wayne L. Lees, inventors (to NASA) Issued 16 Feb. 1971 4 p Filed 27 Feb. 1969 Cl. 29-25.18; Int. Cl. H01j9/16, 9/44
(NASA-Case-ERC-10013; US-Patent-3,562,881; US-Patent-Appl-SN-802972) Avail: US Patent Office CSCL 09A

Field ionization electrodes described consist of an array of microscopically small rods having their lengths and tip configurations equalized. Matching of the electrode elements is accomplished by field evaporation permitted by the high physical strength of the individual rods.
Official Gazette of the U.S. Patent Office

N71-26701* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VACUUM EVAPORATOR WITH ELECTROMAGNETIC ION STEERING Patent
Robert E. Frazer, inventor (to NASA) Issued 19 Jan. 1971 4 p Filed 5 Sep. 1968 Cl. 118-49.5; Cl. 204-298; Int. Cl. C33c13/08 Sponsored by NASA
(NASA-Case-NPO-10331; US-Patent-3,556,048; US-Patent-Appl-SN-757625) Avail: US Patent Office CSCL 09E

A device is described for high vacuum deposition. It consists of a vacuumtight housing and an annular ring with coils. The coils are controllably energized to produce a rotating magnetic field for steering the vaporized material to selected points for depositing the film. F.O.S.

N71-26769# Technische Hochschule in Graz (Austria). Inst. fuer Theoretische Physik.
LOW FREQUENCY LOOP ANTENNA ARRAYS. PART 2 Final Technical Report, Jul. 1969–Sep. 1970
Ernst Ledinegg Dec. 1970 135 p refs
(Contract DAJA37-70-C-0118)
(AD-720599; ARDG(E)-E-1346-Pt-2) Avail: NTIS

The report on Loop Antenna Arrays draws heavily on the previous report AD 693271, particularly for the formulae describing the loop array radiation field. Diagrams 1 to 53 give the radiation characteristics of horizontal arrays consisting of 50 or 100 single co-linear loops for various values of the ground conductivity, distance the current phase between two adjacent loops. For the high gain arrays of Diagrams 19 and 20 gain is increased by a factor equal to the square root of the number of loops. Part B contains an unified derivation and numerical evaluation of the resistance equivalent to the ground reaction as compared to the radiation resistance for both electric and magnetic dipole antennas. The question as to what extent a metallic disc on the ground below the antenna reduces the ground reaction on a vertical electric dipole was given an extensive theoretical treatment in Part C. Part D deals with the influence of perturbations on the far radiation field of an antenna array. Among the cases treated there is one where the perturbation is assumed as a strip where the soil has a conductivity different from that in the remaining domain. The electromagnetic field before and beyond the strip is calculated with the help of the reciprocity theorem. Author (GRA)

N71-26775# Kernforschungszentrum, Karlshruhe (West Germany)
INFLUENCE OF THE RADIAL SLOTS IN THE IRIS DISK OF A WAVEGUIDE ON THE DISPERSION PROPERTIES AND THE QUALITY FACTOR OF A SYSTEM OF AXIALLY SYMMETRIC AND NONAXIALLY SYMMETRIC WAVES [EINFLUSS DER RADIALEN SCHLITZE IN DEN IRRISSCHEIBEN EINES WELLENLEITERS AUF DIE DISPERSIONSEIGENSCHAFTEN UND DEN GUETEFAKTOR EINES SYSTEMS ROTATIONSSYMMETRISCHER UND NICHTROTATIONSSYMMETRISCHER WELLEN]
G. D. Kramskoi et al [1970] 10 p refs Transl. into GERMAN of Akad. Nauk Ukr. SSR, Kharkov, report KHFTI-69-24 In GERMAN
(KFK-tr-334; KHFTI-69-24) Avail: AEC Depository Libraries

On the basis of the data determined for the quality factor and the group velocity of the highest modes EH sub 11 and EH sub 12, the dependence of their damping coefficients on the length and type of the radial slits can be established. The geometry of the radial slits in the iris disk of the accelerator wave guide can also be selected on the basis of these data. Author (NSA)

N71-26787* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
INTERNAL WORK LIGHT Patent
Graydon A. Phlieger, Jr., inventor (to NASA) Issued 16 Feb. 1971 7 p Filed 5 Aug. 1968 Cl. 240-51.11; Cl. 240-11.2; Cl. 240-11.4; Cl. 313-22; Int. Cl. H05B33/04
(NASA-Case-XKS-5932; US-Patent-3,564,234; US-Patent-Appl-SN-752729) Avail: US Patent Office CSCL 09E

A sealed fluorescent tube light is described that can be connected to other similar units to form a string of work lights. The tube light locates and seals the ballast and starter inside of its interior so as to provide compactness and safety during use. A radio frequency interference shield is provided around the tube light to prevent the radiation of electrical interference from the electrical components. Official Gazette of the U.S. Patent Office

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N71-25885* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
VIDEO SYNC PROCESSOR Patent
Darrow L. Webb and Francis Byrne, inventors (to NASA) Issued 2 Mar. 1971 7 p Filed 11 Dec. 1968 Cl. 178-69.5; Int. Cl. H04n5/04
(NASA-Case-KSC-10002; US-Patent-3,567,861; US-Patent-Appl-SN-782956) Avail: US Patent Office CSCL 09C

A video sync processor is described which includes a phase locked loop which compares the horizontal sync of an incoming video signal to the horizontal sync of a local sync generator and thereby locks a voltage control oscillator of the processor to a master oscillator carried in the remote transmitting station. In this manner, all local processing equipment is referenced to the remote master oscillator. Frequently, when signals are received from remote stations, such as spacecrafts, there is a low signal-to-noise ratio and the quality of the signal is poor. In order to improve the stability of the composite signal, the sync and blanking portion are stripped from the incoming video signals and a clean sync and blanking signal from the local sync generator is inserted. As long as horizontal phase-lock is maintained, all ground recording and monitoring equipment are presented with video and clean sync regardless of the signal-to-noise ratio of the signal recieved.
Official Gazette of the U.S. Patent Office

N71-25892* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

VOLTAGE TO FREQUENCY CONVERTER Patent
Donald C. Lokerson, inventor (to NASA) Issued 26 Jan. 1971 8 p Filed 20 Dec. 1968 Cl. 331-113; Int. Cl. H03k3/281
(NASA-Case-GSC-10022-1; US-Patent-3,559,096;
US-Patent-Appl-SN-785546) Avail: US Patent Office CSCL 09C

A voltage controlled, variable frequency relaxation oscillator is described which includes a pair of metal oxide semiconductor field effect transistors (MOSFET's) feeding variable currents to transistors comprising the oscillator. The gate electrodes of the MOSFET's are connected in parallel with a frequency controlling signal source to provide a high impedance to the source. To compensate for the tendency of the MOSFET's to produce a nonlinear oscillator output frequency as a function of source signal level, special circuitry is provided. To maintain the oscillator response constant as a function of temperature and compensate for variations in the characteristics of the MOSFET's as a function of temperature, a regulator circuit including a MOSFET as a voltage reference source is provided. Official Gazette of the U.S. Patent Office

N71-25896*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
COMPUTER AIDED ELECTRONIC CIRCUIT DESIGN Final Report
Michael L. Dertouzos Nov. 1970 67 p refs Sponsored in part by ARPA
(Contract NAS12-2208; Grant NGL-22-009-019; Contract Nonr-4102(01); Proj. MAC
(NASA-CR-118642; ESL-FR-436) Avail: NTIS CSCL 09C

The status of CIRCAL-2, a general purpose on-line circuit-design program is described. It is a final report on research in the area of on-line circuit design. Author

N71-25899* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PNEUMATIC OSCILLATOR Patent
Miles O. Dustin, inventor (to NASA) Issued 9 Mar. 1971 5 p Filed 7 Mar. 1971 Cl. 137-81.5; Cl. 235-201; Int. Cl. F15c1/12
(NASA-Case-LEW-10345-1; US-Patent-3,568,702;
US-Patent-Appl-SN-805298) Avail: US Patent Office CSCL 09C

A pneumatic oscillator or analogue-to-digital converter with fluid oscillator circuit, a conditioning circuit and an output selector circuit is described. Three bistable fluid amplifiers with interconnecting pneumatic R-C circuits make up the oscillator which has a frequency range down to 0 pulses per second. Control signal pressure is supplied to the oscillator through the conditioning circuit which controls the frequency range of the oscillator. Output pulses from the oscillator are directed to one or the other of a pair of output ports through an output selecting circuit. Official Gazette of the U.S. Patent Office

N71-25900* National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
A SOLID STATE ACOUSTIC VARIABLE TIME DELAY LINE Patent
Thomas M. Fitzgerald, inventor (to NASA) Issued 2 Mar. 1971 5 p Filed 6 Sep. 1968 Cl. 333-30; Cl. 333-72; Int. Cl. H03h9/16; Int. Cl. H03h9/30
(NASA-Case-ERC-10032; US-Patent-3,568,103;
US-Patent-Appl-SN-757857) Avail: US Patent Office CSCL 09C

A solid-state variable time delay line is described. A DC voltage applied to the longitudinal axis of piezoelectric material creates a high field domain that propagates along said axis from one end of the material to the other end. An RF pulse is applied to the end of the material toward which the high field domain is traveling. The RF pulse generates an acoustic wave that travels toward the high field domain. When the acoustic wave reaches the high field domain, it is reflected by the moving high field domain back toward the end of the material to which the RF pulse is applied. The total time delay is the time it takes for the acoustic wave to reach the high field domain and be reflected back to the RF input end of the material. By varying the time relationship between the creation of the moving high field domain by the DC voltage and the application of the RF pulse, a variable time delay is provided. Official Gazette of the U.S. Patent Office

N71-25905*# Hughes Aircraft Co., Culver City, Calif. Microelectronic Technology Dept.
STUDY OF DEVELOPMENT PROCESS CONTROLS FOR LINE CERTIFICATION ON HYBRID MICROCIRCUITS Final Report
Frank Keister 3 Mar. 1971 87 p
(Contract NAS8-26380)
(NASA-CR-103168; P71-59) Avail: NTIS CSCL 09C

Flow charts were developed listing the basic process steps used to produce typical hybrid microcircuits. Based on these flow charts, key process steps were selected which should be certified and demonstrated to a NASA certification team as reasonable assurance that the manufacturer's line is capable of producing acceptable and consistent hybrid microcircuits. For each of the key process steps, the manufacturer is asked to identify certain factors, such as type, method, material, controls, processing steps, equipment, test methods, documentation, inspection, and quality assurance criteria. The ten key process steps selected were design and layout, masks and screens, parts and materials control, substrate characterization, film patterning, substrate sizing, trimming, parts mounting, interconnect bonding, and package sealing. Author

N71-25917* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MINIMAL LOGIC BLOCK ENCODER Patent
James O. Duffy, inventor (to NASA) Issued 9 Mar. 1971 10 p Filed 30 Oct. 1968 Cl. 340-347; Int. Cl. H03k13/24 Sponsored by NASA
(NASA-Case-NOP-10595; US-Patent-3,569,956;
US-Patent-Appl-SN-771760) Avail: US Patent Office CSCL 09C

Encoders designed to generate a comma free biorthogonal Reed-Muller type code by means of which 64 6-bit data words are converted for communication purposes into 64 32-bit code words is described. The encoder incorporates a minimal number of logic elements and the circuitry implements an algorithm. Brief descriptions and drawings are included. Author

N71-25950* Airtronics, Inc., Washington, D.C.
INVERTER WITH MEANS FOR BASE CURRENT SHAPING FOR SWEEPING CHARGE CARRIERS FROM BASE REGION Patent
Edward R. Pasciutti and Michael W. Talbot, inventors (to NASA) Issued 9 Sep. 1969 9 p Filed 17 Oct. 1967 Cl. 331-113; Int. Cl. H03k3/28 Sponsored by NASA
(NASA-Case-XGS-06226; US-Patent-3,466,570;
US-Patent-Appl-SN-676387) Avail: US Patent Office CSCL 09C

Provisioning of both an inductance and a saturable reactor in the frequency determining network of a push-pull transformer coupled oscillator-inverter to cause favorable base current shaping is discussed. The reactor thereby drastically reduces base storage time, source voltage and current ripple, and completely eliminates overlap inefficiencies. Official Gazette of the U.S. Patent Office

N71-25985* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BUCK BOOST VOLTAGE REGULATION CIRCUIT Patent
Thomas A. LaVigna, inventor (to NASA) Issued 26 Jan. 1971 6 p Filed 6 Oct. 1969 Cl. 321-2; Int. Cl. H02m3/24
(NASA-Case-GSC-10735-1; US-Patent-3,559,031;
US-Patent-Appl-SN-863963) Avail: US Patent Office CSCL 09C

A buck-boost voltage regulator in which the output of a DC voltage source to be controlled is combined with a source of

alternating current from an inverter is discussed. The resultant signal is applied to a chopper circuit. The chopper circuit utilizes a pair of switching transistors alternately maintained in conduction by a single current transformer and an inductive load. The chopper circuit is designed to permit instantaneous switching between the transistors and is further designed to prevent simultaneous conduction thereof. This allows operation of the chopper circuit through a wide range of frequencies without any long commutation intervals and thereby prevents short circuits from being applied through the transformer to the inverter.

Official Gazette of the U.S. Patent Office

N71-26103* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PARALLEL GENERATION OF THE CHECK BITS OF A PN SEQUENCE Patent
Tage O. Anderson and Warren A. Lushbaugh, inventors (to NASA) Issued 21 Oct. 1969 7 p Filed 22 Nov. 1965 Cl. 340-146.1; Int. Cl. G06f11/00 Sponsored by NASA
(NASA-Case-XNP-04623; US-Patent-3,474,413; US-Patent-Appl-SN-510150) Avail: US Patent Office CSCL 09C

A circuit for generating in parallel 57 check bits of a 63 bit PN code as a function of 6 bits of an input code word, the bits of which comprise 6 of the bits of the PN code is described. The circuit includes 57 two input mod-2 gates, arranged in a tree like structure of a plurality of tree levels. Each of fifteen gates, which form a first group of gates in the first tree level, responds to two of the six bits of the code word, while each of 35 gates, defining a second group of gates in the second tree level, has at least one input connected to the output of one of the gates in the first group. Seven of the remaining gates from a third group of gates in the third tree level, with each one of these gates having at least one input connected to the output of one of the gates in the second group. Official Gazette of the U.S. Patent Office

N71-26142* Hughes Aircraft Co., Los Angeles, Calif.
PHASE MULTIPLYING ELECTRONIC SCANNING SYSTEM Patent
Arthur F. Seaton, inventor (to NASA) Issued 5 Jan. 1971 8 p Filed 11 Aug. 1969 Cl. 343-768; Int. Cl. H01p5/12; Int. Cl. H01q13/10; Int. Cl. H03h7/36 Sponsored by NASA Prepared for JPL
(NASA-Case-NPO-10302; US-Patent-3,553,704; US-Patent-Appl-SN-848811) Avail: US Patent Office CSCL 09C

A hybrid T waveguide junction is disclosed comprising a septum bifurcating a waveguide with variable susceptance in the two resulting branches for controlling the phase and amplitude of radiant energy through each. The difference in radiation through the two branches is then radiated out of an arm comprising an edge (narrow wall) slot and the remaining energy is transmitted through another arm comprising a waveguide continuation beyond the septum and edge slot. The variable susceptance in a given branch comprises voltage variable capacitances in the form of adjustable stubs. The control for the stubs may be in accordance with sine and cosine functions. Official Gazette of the U.S. Patent Office

N71-26326* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TIME SYNCHRONIZATION SYSTEM UTILIZING MOON REFLECTED CODED SIGNALS Patent
Mahlon F. Easterling, inventor (to NASA) Issued 14 Oct. 1969 9 p Filed 21 Dec. 1967 Cl. 58-24; Int. Cl. G04c13/02 Sponsored by NASA
(NASA-Case-NPO-10143; US-Patent-3,472,019; US-Patent-Appl-SN-692331) Avail: US Patent Office CSCL 09C

A time synchronization system is disclosed, including a transmitter unit which transmits a PN coded signal, or simply a PN code, to the moon for reflection to a receiver unit on earth located remotely from the transmitter unit. In the latter, a local PN code is generated. The received and local codes are cross correlated and the cross correlated power is charted on a strip chart. Master and local clocks in the transmitter and receiver units provide minute and second defining signals, used to control the phases of the two codes. The phase of the transmitted code is advanced to compensate for signal transmission time, which changes over a selected measurement period, so that the resulting recorded chart can be utilized to determine time error between the two clocks, to within several microseconds.

Official Gazette of the U.S. Patent Office

N71-26331* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BROADBAND STABLE POWER MULTIPLIER Patent
George F. Lutes, Jr. and Kenneth D. Schreder, inventors (to NASA) Issued 2 Dec. 1969 7 p Filed 15 Sep. 1967 Cl. 330-31; Int. Cl. H03f1/42, 3/10 Sponsored by NASA
(NASA-Case-XNP-10854; US-Patent-3,482,179; US-Patent-Appl-SN-668248) Avail: US Patent Office CSCL 09C

A broadband stable power multiplier, in which a balun is used in each amplitude amplification stage of a multistage unit to provide broadband impedance transformation, is described. Also, a strip line is used to impedance match the very low input impedance of a broadband high power frequency transistor to the output impedance of a preceding power amplifier.

Official Gazette of the U.S. Patent Office

N71-26334* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRECIPITATION DETECTOR Patent
Harold R. Long, Martin J. Menges, and Samual W. Mugler, inventors (to NASA) Issued 20 Apr. 1971 4 p Filed 5 Feb. 1969 Cl. 317-153; Cl. 317-DIG3; Cl. 340-235; Int. Cl. H01h47/36 (NASA-Case-XLA-2619; US-Patent-3,575,641; US-Patent-Appl-SN-796691) Avail: US Patent Office CSCL 09C

A precipitation detector and mechanism used to shut down a load during precipitation and activate a load upon completion of precipitation is described. The detector has thermistors in a bridge circuit. One of the thermistors is exposed to the elements and cooled upon being contacted with precipitation. This causes an imbalance in the bridge circuit the output of which actuates a relay that shuts down the load. Termination of precipitation allows the thermistor to warm up balancing the bridge circuit and the relay closes activating the load.

Official Gazette of the U.S. Patent Office

N71-26339* North American Aviation, Inc., Canoga Park, Calif.
PROPELLENT MASS DISTRIBUTION METERING APPARATUS Patent
Ralph A. Ayvazian, inventor (to NASA) Issued 14 Oct. 1969 3 p Filed 24 Apr. 1968 Cl. 73-432; Int. Cl. G01f11/00, 23/00
(NASA-Case-NPO-10185; US-Patent-3,472,080; US-Patent-Appl-SN-723805) Avail: US Patent Office CSCL 09C

An apparatus is described for metering or recording the spatial distribution of propellent matter, such as droplets or vapor in a stream which is ejected from an injector or nozzle. The apparatus consists of a grid with electrical high resistance screen elements, interconnected at insulating nodal members to form a preselected array or matrix. To meter or record the spatial mass distribution, the grid is placed in the stream's path with an external power supply and readout device selectively connected across each resistance element to record changes in its electrical resistance as a function of droplets or vapor impinging thereon.

Official Gazette of the U.S. Patent Office

N71-26374* National Aeronautics and Space Administration. Goddard Spacecraft Center, Greenbelt, Md.
ADAPTIVE SYSTEM AND METHOD FOR SIGNAL GENERATION Patent
Richard H. Foote and Donald A. Figgins, inventors (to NASA)

Issued 16 Dec. 1969 18 p Filed 13 Oct. 1967 Cl. H03b3/04
(NASA-Case-GSC-11367; US-Patent-3,484,712;
US-Patent-Appl-SN-675238) Avail: US Patent Office CSCL 09C

A satellite timing or clock pulse system is described for generating a predetermined integral number of equally spaced signals during the time period between recurrent reference signals subject to broad variation in frequency. The error sensing and correction logic circuitry, and circuit operation are discussed. Details are given on the application in which a satellite receives one sun pulse each rotation, serving as the reference signal and generating the predetermined number of clock pulses between each sun pulse. These clock pulses are then used to generate one television scanning line during each rotation. Since the spin rate of the satellite may fall in a wide range and is subject to change, the clock pulse generating system is designed to adjust atuomatically to the sun pulse frequency. N.E.N.

N71-26414* TRW Systems Group, Redondo Beach, Calif.
MULTIPLE VARACTOR FREQUENCY DOUBLER Patent
Joseph H. Habra, inventor (to NASA) Issued 18 Mar. 1969 3 p Filed 18 Mar. 1969 Cl. 321-69; Int. Cl. H02m5/16; Int. Cl. H01p7/00 Sponsored by NASA
(NASA-Case-XMF-04958-1; US-Patent-3,434,037;
US-Patent-Appl-SN-448365) Avail: US Patent Office CSCL 09C

A frequency multiplier comprising a dual cavity device in which the input cavity resonates at a frequency of omega sub 1 and an output cavity arranged to resonate at a frequency of 2 omega sub 1 is described. A pair of varactor elements external to the input cavity is coupled to the input cavity for generating current of the desired output frequency. The output cavity includes the dual varactors as part of the tuned circuit for generating the desired multiplied frequency. Official Gazette of the U.S. Patent Office

N71-26415* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CASCADED COMPLEMENTARY PAIR BROADBAND TRANSISTOR AMPLIFIERS Patent
George D. Thompson, Jr. and George F. Lutes, Jr., inventors (to NASA) Issued 12 Aug. 1969 5 p Filed 9 May 1967 Cl. 330-13; Int. Cl. H03f3/18, 3/68, 3/42 Sponsored by NASA
(NASA-Case-NPO-10003; US-Patent-3,461,393;
US-Patent-Appl-SN-638192) Avail: US Patent Office CSCL 09C

A broadband distribution amplifier with a plurality of output stages is discussed. Each stage is formed of a complementary transistor pair, interconnected by a parallel capacitor and resistor network so that even at high frequencies, for example 50 mc., one of the transistors provides a very low impedance discharge path for the capacitor, to prevent bottoming. AGC is provided by inserting a thermistor into the input stage of the amplifier which receives the high frequency or RF input signals. The thermistor, due to its pure resistive characteristics, does not produce undesired phase shifts with changing frequencies. Furthermore, due to its small size, stray the capacitance produced is held to a minimum. Official Gazette of the U.S. Patent Office

N71-26418* National Aeronautics and Space Administration. Goddard Spacecraft Center, Greenbelt, Md.
CONTROL APPARATUS FOR APPLYING PULSES OF SELECTIVELY PREDETERMINED DURATION TO A SEQUENCE OF LOADS Patent
Leo J. Veillette, inventor (to NASA) Issued 9 Dec. 1969 4 p Filed 27 Jul. 1966 Cl. 340-174; Int. Cl. G11b5/00; Int. Cl. H03k3/00, 21/00
(NASA-Case-XGS-04224; US-Patent-3,483,535;
US-Patent-Appl-SN-568364) Avail: US Patent Office CSCL 09C

A control apparatus is described which includes a plurality of gating circuits for sequentially applying a plurality of pulses to a load, whereby each gating circuit is activated by a delay network to apply a pulse for a desired predetermined period. Information indicative of the activation of any gating circuit is stored and a selection circuit, which is responsive to the stored information and input pulse trains, selectively activates successive gating circuits, in conjunction with associated delay networks, such that the load is pulsed for the predetermined desired period in a selected sequence. Official Gazette of the U.S. Patent Office

N71-26434* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIGITAL MEMORY IN WHICH THE DRIVING OF EACH WORD LOCATION IS CONTROLLED BY A SWITCH CORE Patent
Lawrence J. Zottarelli, inventor (to NASA) Issued 12 Aug. 1969 6 p Filed 16 Sep. 1965 Cl. 340-174; Int. Cl. G11c7/00 Sponsored by NASA
(NASA-Case-XNP-01466; US-Patent-3,461,437;
US-Patent-Appl-SN-487940) Avail: US Patent Office CSCL 09C

A digital memory system including a plurality of word locations, each comprised of a plurality of memory elements having a common drive line is described. A different switch core is provided for each memory location with the drive line coupled to that location being connected in series with a first winding on the switch core. A different resistance path is connected in parallel across each serially connected drive line and first winding. Current is driven in a first direction through a drive line to switch the switch core coupled there to a set state without destroying information stored in memory elements coupled to that drive line. The set switch core is reset by driving current through a second winding which induces a current in the drive line coupled in a first direction, which does not destroy the information stored in the memory elements. Thus, a switch core can be uniquely selected without destroying information stored in any of the memory elements. Official Gazette of the U.S. Patent Office

N71-26435 Denver Univ., Colo.
ELECTRICAL CONDUCTION IN CERMET FILMS
Thomas Edward Christen (Ph.D. Thesis) 1969 93 p
Avail: Univ. Microfilms Order No. 71-11922

The electrical conduction mechanism for cermet films was investigated from a simplified structure point of view. Three models are presented for the low resistivity cermets. The first model is based on scattering of free electrons off insulator particles. The other models assume simple geometry for the metal-dielectric mixture and attribute the increase in resistivity to size effects. These models are worked out as solutions to the Boltzmann transport equation. The theory is compared with experimental data taken on Au-SiO2 and Au-SiO cermet films. The Results show a good correlation between the experimental data and the scattering model. The high resistivity model is based on a thermally activated electron tunneling process between metal microparticles. The data also indicate an activated process and this activation energy is determined for different high resistivity cermets. Dissert. Abstr.

N71-26436 Florida Univ., Gainesville.
DESIGN OF A MULTIPLE-ELEMENT RECEIVER FOR A TIME-VARIABLE CHANNEL
William E. Daley (Ph.D. Thesis) 1969 66 p
Avail: Univ. Microfilms Order No. 70-12230

The problem of detecting a known signal passed through a linear random channel is examined for the small S/N case. The general form of this detector is derived and discussed. Then the problem is specialized to the distorted wavefront case. This problem is discussed under two signal conditions. The first is when the signal is known exactly except for initial phase. The detector consists of envelope matched filters whose outputs are combined in a manner determined by the wavefront statistics. The second signal situation examined is when the channel so distorts the signal that the waveshape is no longer known. The receiver in this case is essentially a set of autocorrelation or power measuring devices whose

outputs are combined in a manner determined by the wavefront
Dissert. Abstr

N71-26444 Brown Univ., Providence, R.I.
ON THE DISCRETE CONTROL PROBLEM
Yeheskel Bar-Ness (Ph.D. Thesis) 1969 254 p
Avail: Univ. Microfilms Order No. 70-8687

The discrete Euler equation is established and used in the solution of the linear regulator problem. Using the Laplace transform of the discrete Euler equation, a root square locus that connects the location of the closed loop poles with the weighting matrices of the cost functional is derived. A discrete version of the Hamilton-Jacobi equation is used in the solution of the stochastic control problem. The minimization of the ripple between sampling time and the question of preservation of controllability under sampling are investigated. It is proven that the solution of the time invariant regulator problem may be obtained as an eigenvalue problem, i.e., it is possible to get the feedback matrix, directly, from the eigenvectors of a certain compound matrix composed of the coefficients of the system and the weighting matrices. Also, it is shown that the eigenvalues of the compound matrix are the closed loop poles of the optimal system. Dissert. Abstr.

N71-26531* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TURN ON TRANSIENT LIMITER Patent
Frederick C. Hallberg, inventor (to NASA) Issued 12 Jan. 1971 6 p Filed 31 Dec. 1968 Cl. 317-20; Cl. 317-33; Int. Cl. H03h9/00
(NASA-Case-GSC-10413; US-Patent-3,555,361; US-Patent-Appl-SN-789043) Avail: US Patent Office CSCL 09C

This disclosure describes a turn on current transient limiter that controls the peak current that can flow into a high capacity load when voltage is initially applied to the load. A plurality of silicon controlled rectifier (SCR) circuits are connected in a parallel arrangement with the parallel arrangement being connected in series with the load. All of the SCR circuits except the last one, include current limiting means. The SCR circuits are sequentially switched on when voltage is initially applied and limit current until the last one is switched on at which time current transients have dropped below a predetermined level.
Official Gazette of the U.S. Patent Office

N71-26544* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANALOG SIGNAL INTEGRATION AND RECONSTRUCTION SYSTEM Patent
Nazem A. Habbal, inventor (to NASA) Issued 23 Feb. 1971 10 p Filed 29 May 1968 340-347; Int. Cl. H03k13/20 Sponsored by NASA
(NASA-Case-NPO-10344; US-Patent-3,566,396; US-Patent-Appl-SN-732921) Avail: US Patent Office CSCL 09C

Transient data such as that relating to the radiant energy incident to a shock wave in a gas shock tube is converted to an analog signal and displayed on the screen of an oscilloscope. A video scanning means scans the amplitude axis of the displayed signal at predetermined intervals along the time axis of the signal and generates a first indicia when each scan is initiated and a second indicia when the scan intersects the displayed signal. A counting means initiates a count in response to the first indicia of each scan and terminates the count when the second indicia is generated. During the interval between scans the data in the counting means, a digital representation of the amplitude of the displayed signal at the position of the scan, is shifted into a computer memory for storage. The stored digital data may be used either to calculate the area beneath the displayed waveform or for subsequent reconstruction thereof.
Official Gazette of the U.S. Patent Office

N71-26577* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RAPID SYNC ACQUISITION SYSTEM Patent
Tage O. Anderson and Albert J. Gallo, inventors (to NASA) Issued 23 Feb. 1971 6 p Filed 9 Feb. 1968 Cl. 325-41; Int. Cl. H04b1/00 Sponsored by NASA
(NASA-Case-NPO-10214; US-Patent-3,566,268; US-Patent-Appl-SN-704299) Avail: US Patent Office CSCL 09C

A system is described for reducing sync-acquisition time in a data communication system. In this system synchronization is achieved as a function of the phase correlation of a PN code, generated in a ground station and received by a spacecraft, and a similar PN code which is generated in the spacecraft. The system includes circuitry which is incorporated in the spacecraft to sample the phase of the PN code generated there and to communicate the phase of the sampled code to the ground station, via a telemetry channel. At the ground station, the phase of the sampled spacecraft PN code is used to set a ground PN code generator so that when the ground PN code is transmitted to and arrives at the spacecraft, it is substantially in phase with the PN code, generated in the spacecraft.
Official Gazette of the U.S. Patent Office

N71-26578 Cornell Univ., Ithaca, N.Y.
APPROXIMATE SWITCHING SURFACES FOR THE OPTIMAL CONTROL OF NONLINEAR SYSTEMS
Kenneth Lee Labsock (Ph.D. Thesis) 1969 84 p
Avail: Univ. Microfilms Order No. 70-5803

A method has been developed which permits the computation of an approximate switching surface in about one percent of the time required for computation of the exact surface. The method uses the two variable expansion procedure to develop expansions for the state and adjoint variables. These expansions are combined to give power series expansions for the coordinates of points on the approximate switching surface. The expansions are in terms of powers of the parameter of nonlinearity of the system, and the coefficients are functions only of the coordinates of points on a known segment of the switching surface. Dissert. Abstr.

N71-26612# Forsvarets Forskningsanstalt, Stockholm (Sweden). Avdelning 3.
MODEL FOR SIMULATION OF DISTURBANCES IN A CONNECTION NETWORK [MODELL FOER SIMULERING AV STOERNING MOT SAMBANDSNAET]
P.-O. Bergman, F. Linden, and B. Lindblad Jul. 1969 99 p refs In SWEDISH
(FOA-3-A-3727-63) Avail: NTIS

A model for the computerized simulation of intentional jamming of narrowband and broadband receivers in very high frequency or radio frequency communications is described that uses the received signal-to-noise ratio as effective measuring method. The IBM 7090 computer program is written in FORTRAN.
Transl. by G.G.

N71-26626* National Aeronautics and Space Administration. Goddard Spacecraft Center, Greenbelt, Md.
VOLTAGE REGULATOR WITH PLURAL PARALLEL POWER SOURCE SECTIONS Patent
William G. Binckley and Warren H. Wright, inventors (to NASA) Issued 25 Nov. 1969 8 p Filed 28 Jul. 1966 Cl. 307-53; Int. Cl. H02j1/10, 3/38, 7/34
(NASA-Case-GSC-10891-1; US-Patent-3,480,789; US-Patent-Appl-SN-568620) Avail: US Patent Office CSCL 09C

A system for regulating or limiting the dissaptive output voltage of various power sources is described. The dissaptive paths comprise shunt paths connected across the power source sections which are connected in series. The paths are controlled in response to the output of a comparator which compares the bus voltage against a reference. E.H.W.

N71-26703*# Grumman Aerospace Corp., Bethpage, N.Y.
ESTABLISHING AN ELECTRICAL TEST PHILOSOPHY FOR LSI MICROCIRCUITS, VOLUME 1 Final Report, 15 May 1970 - 15 Feb. 1971
Edward Keonjian and Laurence Mizell Feb. 1971 63 p refs
(Contract NAS8-25835)
(NASA-CR-103165) Avail: NTIS CSCL 09C

A preliminary study on various contemporary LSI testing techniques was conducted. The techniques were categorized into logic type (combinatorial and sequential), and types of electrical testing (functional and parametric). First, electrical parameters specified on each type of LSI device were listed and the parameters specified by each manufacturer were tabulated. A complete listing of 38 LSI manufacturers and users was then compiled and categorized and a questionnaire outlining areas of specific interest was written and forwarded. A study was made of available data, failure analysis reports, technical journals, parameter in-house user experience. A study was also made of available LSI test equipment. The electrical parameters test philosophy included an evaluation of all parameters specified to assess how useful each is in predicting the performance and reliability of the device. Author

N71-26704*# Grumman Aerospace Corp., Bethpage, N.Y.
ESTABLISHING AN ELECTRICAL TEST PHILOSOPHY FOR LSI MICROCIRCUITS, VOLUME 2 Final Report, 15 May 1970 - 15 Feb. 1971
Edward Keonjian and Laurence Mizell Feb. 1971 30 p ref
(Contract NAS8-25835)
(NASA-CR-103166) Avail: NTIS CSCL 09C

Specific guidelines are developed for high-reliability testing at the wafer and package levels. Functional and parametric testing is discussed and recommendations are made for MOS and bipolar devices. Specifications for an LSI test system are outlined. Author

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N71-25604# Naval Civil Engineering Lab., Port Hueneme, Calif.
AIRFIELD PAVEMENT CONDITION SURVEY, USNS ADAK, ALASKA
David J. Lambiotte and Robert B. Brownie Jan. 1971 63 p refs
(AD-719889; NCEL-TN-1138) Avail: NTIS CSCL 1/5

The results of a condition survey of the airfield pavements at the U. S. Naval Station, Adak, Alaska are presented. The survey established statistically-based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts. Author (GRA)

N71-25857*# North American Rockwell Corp., Downey, Calif. Space Div.
LUNAR BASE SYNTHESIS STUDY. VOLUME 1: EXECUTIVE STUDY Final Report
J. M. Mansfield, T. J. Dolan, R. B. Carpenter, Jr., and R. G. Johns, Jr. 15 May 1971 32 p
(Contract NAS8-26145)
(NASA-CR-103127; SD-71-477-1) Avail: NTIS CSCL 22A

A lunar surface base concept was synthesized by considering the top level program objectives and deriving hardware/operational approaches that best accomplished these objectives. The lunar surface base requirements were found to fall into two main categories of surface activities: main base activities which included astronomy and deep drilling as well as the regular logistics and housekeeping functions, and the selenological explorations at multiple sites in an expanded region around the base site. A lunar surface base configuration which included a main base and surface mobility system elements was derived. The main base/mobility system concepts must be integrated, involving mainly the main base/mobility system electrical power and environmental control/life support systems. The logistics requirements and operational concepts for a selected lunar surface base concept, and a conceptual design of a lunar shelter derived from a specified space station module are presented. Cost and resource estimates are presented for the design and development of each of the shelter configurations and for the science, mobility, and power source elements. Author

N71-25858*# North American Rockwell Corp., Downey, Calif. Space Div.
LUNAR BASE SYNTHESIS STUDY. VOLUME 2: MISSION ANALYSIS AND LUNAR BASE SYNTHESIS Final Report
J. M. Mansfield, T. J. Dolan, R. B. Carpenter, Jr., and R. G. Johns, Jr. 15 May 1971 319 p refs
(Contract NAS8-26145)
(NASA-CR-103129; SD-71-477-2) Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

Lunar exploration missions were defined and analyzed in order to establish the role of a semi-permanent lunar surface base (LSB) as an element of an integrated space program, and to prepare conceptual designs for two different lunar surface shelters. One shelter concept was to be optimized for the LSB mission requirements whereas the other represented a potential adaptation of a specified space station module. The lunar surface base would support a two- to five-year program of scientific and exploration activities in the 1980's by a crew of up to 12 men at any location on the moon. The basic approach involved the identification of scientific and exploration activities appropriate to a single, semi-permanent base on the lunar surface from an examination of the consensus of previous studies of lunar scientific missions. The definition of a program encompassing these activities, the associated operational and design requirements, the logistics operational concepts, and the precursor surface and orbit missions are presented. Author

N71-25859*# North American Rockwell Corp., Downey, Calif. Space Div.
LUNAR BASE SYNTHESIS STUDY. VOLUME 2: APPENDIXES Final Report
15 May 1971 282 p
(Contract NAS8-26145)
(NASA-CR-103128; SD-71-477-2-App) Avail: NTIS CSCL 22A

The appendixes presented are the LSB science equipment list, lunar surface experiment definitions, requirements analysis sheets, surface navigation concepts, LSB site mathematical model, experiment manpower allocations, and surface mission trade studies. Author

N71-25860*# North American Rockwell Corp., Downey, Calif. Space Div.
LUNAR BASE SYNTHESIS STUDY. VOLUME 3: SHELTER DESIGN Final Report
J. M. Mansfield, T. J. Dolan, R. B. Carpenter, Jr., and R. G. Johns, Jr. 15 May 1971 345 p refs

(Contract NAS8-26145)
(NASA-CR-103130; SD-71-477-3) Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

Two shelter designs are presented, one optimized for the LSB mission requirements and the other a potential adaptation of a specified space station module. The baseline shelter complex was configured using eight 15-foot diameter by 30-foot modules. It provided a circular floor plan with three crew modules, a lab module, a drive-in warehouse, and a pressurized garage. It is responsible to all the safety criteria. The modular space station derivative shelter complex is composed of an MSS core module, three crew modules, two control modules, and a galley module, and satisfies the LSB requirement with only minor modifications and the addition of two drive-in/airlock modules. The support operations and resulting systems are defined. The mobility concept includes a prime mover, attachments, and trailers. The base buildup operations and sequence were defined, including the requirement for soil movement and its influence on the support equipment. Author

N71-25861*# North American Rockwell Corp., Downey, Calif. Space Div.
LUNAR BASE SYNTHESIS STUDY. VOLUME 3: APPENDIXES Final Report
15 May 1971 103 p refs
(Contract NAS8-26145)
(NASA-CR-103131; SD-71-477-3-App) Avail: NTIS CSCL 22A

The appendixes presented are egress/ingress operations, active thermal control, specification for a mobile electrical power system, MSS/LSB landing site considerations, and lunar surface base maintenance plan. Author

N71-25862*# North American Rockwell Corp., Downey, Calif. Space Div.
LUNAR BASE SYNTHESIS STUDY. VOLUME 4: COST AND RESOURCE ESTIMATES Final Report
J. M. Mansfield, T. J. Dolan, R. B. Carpenter, Jr., and R. G. Johns, Jr. 15 May 1971 247 p refs
(Contract NAS8-26145)
(NASA-CR-103132; SD-71-477-4) Avail: NTIS CSCL 22A

The results of the cost and resource estimates study are presented for both the baseline lunar base shelter and the modular space station derivative shelter configuration, and for the related scientific, mobility, and power supply equipments. Basic planning documents include schedules and cost estimates, preliminary analysis, definition, design, manufacturing, testing, ground operations, launch operations, mission operations, and related activities. The planning documents consist of eight principal elements: hardware trees, work breakdown structures, program development schedules, hardware utilization lists, shelter program cost estimates, cost estimates breakdown for baseline shelters, cost estimates breakdown for modular space station derivative shelters, and cost and resource estimates for scientific, mobility, and power supply. Author

N71-26214*# Arizona Univ., Tucson.
STAFF QUARTERS FOR HIGH ALTITUDE OBSERVATORY
Ferdinand A. de Weiss *In its* Commun. of the Lunar and Planetary Lab., Commun. Nos. 153–159, Vol. 8, Pt. 5 1970 p 382–383 *Its* Comm. No. 156, App. 2 (See N71-26209 14-30)
Avail: NTIS CSCL 14B

Living and sleeping quarters with an atmosphere of controlled temperature, humidity, and pressure are described for high altitude personnel. The pressurization to 10.5 psi which is equated to an altitude of 9000 ft is considered sufficiently high not to cause discomfort. A suggested design using three steel tanks of the type used for storage under pressure with portholes and air locks is included with estimates of the construction costs. F.O.S.

N71-26215*# Presbyterian-St. Lukes Hospital, Chicago, Ill.
MEDICAL PROBLEMS AT HIGH ALTITUDE SITES AND THE MOUNT LOGAN, YUKON, HIGH CAMP
I. Drummond Rennie *In* Ariz. Univ. Commun. of the Lunar and Planetary Lab., Commun. No. 153–159, Vol. 8, Pt. 5 1970 p 385–390 refs Ariz. Univ. Commun. No. 157 (See N71-26209 14-30)
Avail: NTIS CSCL 14B

Logan High Camp is described, and medical aspects including hypoxia, and secondary changes of the high altitude environment are discussed. The symptoms of acute mountain sickness, which all newcomers to Logan develop are enumerated with the frequent medical disorders such as persistant dry cough, painful external hemorroids, and insomnia. It is considered essential that the newcomer is examined daily by an acclimatized physician. F.O.S.

N71-26258# Foravarets Forskningsanstalt, Stockholm (Sweden).
A STUDY OF THE DATA MEASURING INSTALLATION BLACK ARROW IN GREAT BRITAIN, 6–10 OCTOBER 1969 [STUDIUM AV MAETDATAANLAEGGNINGEN BLACK ARROW I STORBRITANNIEN, 6.10 – 10.10 1969]
Bruno Engstroem and Goesta Wilhelmsson Dec. 1969 6 p In SWEDISH
(FOA-3-C-3616-68) Avail: NTIS

Briefly described are the organizational systems and management structures of the data processing installations for the Black Knight rocket in Farborough, as well as the facility for manufacturing the data measuring tape recorder in Reading, England. G.G.

N71-26269# Naval Civil Engineering Lab., Port Hueneme, Calif.
AIRFIELD PAVEMENT CONDITION SURVEY, USNAS QUONSET POINT, RHODE ISLAND
D. J. Lambiotte and L. J. Woloszynski Feb. 1971 81 p refs
(AD-720691; NCEL-TN-1147) Avail: NTIS CSCL 13/2

The results of a condition survey of the airfield pavements at the U. S. Naval Air Station, Quonset Point, Rhode Island, are presented. The survey established statistically-based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts. Author (GRA)

N71-26301# Consortium of Universities, Washington, D.C. Urban Transportation Center.
DULLES INTERNATIONAL AIRPORT ACCESS
Robert G. Baxter [1970] 44 p refs Prepared in cooperation with Md. Univ.
(PB-194084) Avail: NTIS CSCL 13B

An examination of the growth potential and requirements for continued improvement of Dulles International Airport is presented. An analysis of the relationship between the daily vehicular volumes on the Dulles Airport access road and the number of daily departing passengers is used as a basis for determining the adequacy of access routes to the airport. Author

N71-26486# Air Line Pilots Association, International, Chicago, Ill.
ALPA: A SURVEY OF AIRPORT FIRE AND RESCUE FACILITIES, 1971, NORTH AMERICA
B. V. Hewes, P. R. Robinson, and A. L. Couch 1971 154 p
Avail: NTIS

A survey of airports in the United States in order to determine

the status of the crash fire and rescue equipment available for use in case of an accident involving a scheduled trunk or local service air carrier aircraft is discussed. Only those airports receiving daily service are included and only fire and rescue equipment located within the airport boundaries is reported. Off airport equipment is not considered capable of meeting the response time requirement of 2 to 3 minutes considered a maximum by expert authorities and, therefore, can only be utilized for back up purposes. When this survey was first conducted 4 years ago, almost 50% of airports in the United States had no fire and rescue capability whatsoever. This number has now been reduced to 25 percent. Author

N71-26526# Peat, Marwick, Mitchell and Co., Washington, D.C.
TRAFFIC CIRCULATION STUDY, NATIONAL AIRPORT. BALTIMORE-WASHINGTON AIRPORT ACCESS STUDY: IMMEDIATE ACTION IMPROVEMENTS
Jun. 1970 24 p refs Prepared for Metropol. Wash. Council of Govt.
(Rept-3) Avail: Issuing Activity

The problem of surface transportation access and circulation at Washington National Airport, District of Columbia, is discussed. Recommendations for improving airport access and reducing traffic congestion are presented. Author

N71-26598*# Philco-Ford Corp., Palo Alto, Calif. WDL Div.
DEVELOPMENT OF BONDING AND GROUNDING CRITERIA FOR JOHN F. KENNEDY SPACE CENTER. VOLUME 1: BONDING AND GROUNDING CRITERIA Final Report, 7 Nov. 1969 - 30 Jun. 1970
30 Jun. 1970 86 p refs
(Contract NAS10-6879)
(NASA-CR-118486; WDL-TR4201-Vol-1) Avail: NTIS CSCL 14B

A set of criteria for bonding and grounding at the Kennedy Space Center are presented. These criteria cover the bonding and grounding measures to be taken for minimizing hazards from electrical fault, lightning, explosion and EMI, including reradiation from nonlinear junctions. These criteria are applicable to both new and existing facilities. Author

N71-26599*# Philco-Ford Corp., Palo Alto, Calif. WDL Div.
DEVELOPMENT OF BONDING AND GROUNDING CRITERIA FOR JOHN F. KENNEDY SPACE CENTER. VOLUME 2: EVOLUTION OF BONDING AND GROUNDING CRITERIA AND ON-SITE EVALUATION OF BONDING AND GROUNDING PRACTICES Final Report, 7 Nov. 1969 - 30 Jun. 1970
30 Jun. 1970 170 p refs
(Contract NAS10-6879)
(NASA-CR-118482; WDL-TR4201-Vol-2) Avail: NTIS CSCL 14B

An on-site evaluation of the current implementation of bonding and grounding at KSC is presented. Other tasks reported include a review of existing bonding and grounding practices for KSC and other installations, a definition of hazard conditions at KSC, a definition of required changes, and the updating of existing criteria. Author

N71-26600*# Philco-Ford Corp., Palo Alto, Calif. WDL Div.
DEVELOPMENT OF BONDING AND GROUNDING CRITERIA FOR JOHN F. KENNEDY SPACE CENTER. VOLUME 3: BONDING AND GROUNDING PREVENTATIVE MAINTENANCE INSTRUCTIONS Final Report, 7 Nov. 1969 - 30 Jun. 1970
30 Jun. 1970 69 p refs
(Contract NAS10-6879)
(NASA-CR-118481; WDL-TR4201-Vol-3) Avail: NTIS CSCL 14B

A set of preventive maintenance instructions for electrical grounding and bonding is presented. A major part of the bonding and grounding anomalies found during the on-site evaluation would not have existed had a systematic program of preventive maintenance been in effect. A program for all of Launch Complex 39 and the manned spacecraft operation building is provided. Provision for reporting discrepancies and their follow-up is also included. Author

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N71-25603# Naval Ship Research and Development Center, Washington, D.C.
FLUTTER AND DIVERGENCE CHARACTERISTICS OF FOUR LOW MASS RATIO HYDROFOILS Final Report
Peter K. Besch and Yuan-Ning Liu Jan. 1971 52 p refs
(AD-719891; NSRDC-3410) Avail: NTIS CSCL 20/4

Four low mass ratio hydrofoil models of aspect ratio 5 were flutter tested. The flutter speed of the mass ratio 0.963 model was 24.7 knots. The other three models, of mass ratios 0.455, 0.395, and 0.202, were subject to static failure in bending at about 36 knots and did not flutter below this speed. The results were compared with the predictions of three flutter theories. All theories gave conservative flutter speed predictions at mass ratio 0.963. Two of the theories were also conservative at mass ratio 0.455. Author (GRA)

N71-25655# Aeronautical Research Associates of Princeton, Inc., N.J.
AN ATTEMPT TO CONSTRUCT AN ANALYTICAL MODEL OF THE START OF COMPRESSIBLE TRANSITION Final Report, Sep. 1969 - Sep. 1970
Coleman du P. Donaldson, Roger D. Sullivan, and John E. Yates
Wright-Patterson AFB, Ohio AFFDL Jan. 1971 81 p refs
(Contract F33615-70-C-1032)
(AD-719759; ARAP-150; AFFDL-TR-70-153) Avail: NTIS CSCL 20/4

The results of the first step in an attempt to develop a model of compressible transition are reported. The basis of the method goes back to the equations used by Reynolds many years ago to study incompressible viscous instabilities and turbulence. In the work reported here, a simplified linearized version of a set of equations which has been proposed to study complete transitions and turbulent boundary layers in compressible flow are solved by machine computation in order to evaluate the general character of compressible instability that is given by the model. These results are discussed in the light of results obtained from classical stability calculations. Finally, by coupling the instability calculation to the mean flow equation through the Reynolds stress term, the general character of the run-out of instability (as defined by the simplified equations) to the start of transition is investigated. Author (GRA)

N71-25714# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON TRANSONIC FLOW PERTURBATIONS CAUSED BY VORTICITY
G. B. Ilinskaya et al [1971] 4 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (USSR), no. 1, 1971 p 168 - 170
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Plane vortical gas flows in the neighborhood of a point of orthogonality of the sonic line to the velocity vector are studied.

Such points originate in the transonic flow over a wing profile in the external boundary layer region, where there is a transverse velocity gradient. Flows in which the acceleration is negative ahead of the sonic point are investigated. They can originate in the flow around a wing profile with a peak pressure distribution, when intense compression waves starting from the sonic line retard the flow in the local supersonic zone. The gas motion is described by the continuity, vortex, and Bernoulli equations. Author

N71-25765# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

IRREGULAR REFRACTION OF STRONG SHOCK WAVES BY A WEDGE OF HOT GAS Final Report

James G. Skifstad Dec. 1970 49 p refs

(AD-720818; ARL-70-0343) Avail: NTIS CSCL 20/4

A theoretical model for the irregular refraction of a plane shock wave by a wedge of hot gas was developed to determine the attenuation of the incident shock by the hot gas. The analysis was based on the assumption that the entire flow field is pseudo-stationary. Computations were made for a wedge half-angle of 5 degrees, Mach numbers from 3 to 9, and sound-speed ratios from 2 to 6. The results showed the Mach Number of the transmitted shock to be some 10 to 20 per cent lower than that for normal refraction at the same Mach number and with the same sound speed ratio. The difference was interpreted as being due to the attenuation of the incident shock by the expansion wave behind the shock system. Author (GRA)

N71-25868# Douglas Aircraft Co., Inc., Long Beach, Calif.

CALCULATION OF VISCOUS DRAG AND TURBULENT BOUNDARY LAYER SEPARATION ON TWO DIMENSIONAL AND AXISYMETRIC BODIES IN INCOMPRESSIBLE FLOWS

Tuncer Cebeci, G. J. Mosinskis, and A. M. O. Smith Nov. 1970 87 p refs

(Contract N00014-70-C-0099)

(AD-720775; MDC-J0973-01) Avail: NTIS CSCL 20/4

The report studies the accuracy of calculating the total drag of two-dimensional and axisymmetric bodies and the accuracy of calculating the location of turbulent boundary-layer separation in flows past such bodies. The drag calculations were made by using the Douglas boundary-layer method. This is an implicit finite-difference method applicable to both laminar and turbulent boundary layers. The method also accounts for the transverse curvature effects. In general, comparison of calculated and experimental drag coefficients for both two-dimensional and axisymmetric bodies are in good agreement with experiment. The separation calculations were made by considering four different separation-prediction methods. They are the Douglas boundary-layer method, Heads method, Stratfords method and Goldschmieds method. Author (GRA)

N71-25908# Lockheed Missiles and Space Co., Palo Alto, Calif.

ESTIMATE OF THE INFLUENCE OF VARIOUS GAS EJECTION SOURCES ON POLLUTION IN THE ATMOSPHERE

I. Ya. Sigal et al [1971] 6 p refs Transl. into ENGLISH from Ukr. Khim. Zh. (Ukrainia SSR), v. 37, no. 2, 1971 p 140–145

Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Norms for limiting admissible concentrations (LAC) of toxic gases and vapors are given in tabular form. Some large scale sources of toxic ejections into the atmosphere, as chemical producers, thermal electric stations, and automobiles are compared analytically. General toxicity indices, utilizing the maximum single LAC as basis for conversion, are introduced for comparative estimates of various sources of atmospheric pollution. Author

N71-25927# Air Force Academy, Colo. Frank J. Seiler Research Lab.

NEW INTERPRETATIONS OF NORMAL SHOCK WAVES STRUCTURE IN RADIATING GASES

David Finkelman Mar. 1971 24 p refs

(AD-720821; SRL-TR-71-0002) Avail: NTIS CSCL 16/3

Superposition of a velocity component normal to the oncoming flow allows analyses of radiatively structured normal shock waves to be interpreted in terms of radiating flows about a class of two-dimensional bodies. Analytical descriptions of such bodies are obtained for radiative transfer in a narrow spectral band and for gray body emission. Application of the solutions obtained to general two-dimensional radiative gasdynamics is discussed. The bodies considered are pointed but not necessarily slender, and vehicles of this type are of interest for very high speed ballistic reentry. Author (GRA)

N71-25938# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.

EXPERIMENTAL STUDIES OF RADIATION DRIVEN WAVE PROPAGATION IN A RADIATING GAS Annual Progress Report, 1 Jan. – 31 Dec. 1970

Walter G. Vicenti and Donald Baganoff Jan. 1971 20 p refs

(Contract N00014-67-A-0112-0017)

(AD-720406) Avail: NTIS CSCL 7/4

The report summarizes research into the determination of the vibrational relaxation time in both CO2 and CO, using radiatively driven acoustic waves. GRA

N71-25940*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMPARISON OF NONCAVITATION AND CAVITATION PERFORMANCE FOR 78 DEG, 80.6 DEG, AND 84 DEG HELICAL INDUCERS OPERATED IN HYDROGEN

Royce D. Moore and Phillip R. Meng Washington May 1971 24 p refs

(NASA-TN-D-6361; E-5972) Avail: NTIS CSCL 20D

Three different helical inducers were tested in liquid hydrogen. The tip helical angles were 78 deg, 80.6 deg, and 84 deg. The pressure requirements as well as the thermodynamic effects of cavitation for head rise coefficient ratio of 0.70 were the greatest for the 84 deg inducer and least for the 78 deg inducer for a given flow coefficient ratio. The noncavitating flow range was the greatest for the 78 deg inducer and least for the 84 deg inducer. Author

N71-25998*# Translation Consultants, Ltd., Arlington, Va.

VARIABLE AERODYNAMIC FORCES IN A TURBINE STAGE INDUCED BY A VANE CASCADE IN THE WAKE OF A PRECEDING CASCADE [PEREMENNYYE AERODINAMICHESKIYE SILY V TURBINNOY RESHETKE, VOZBUZHDAYEMYYE POSLEDUYUSCHCHIM LOPATOCHNYM APPARATOM]

A. S. Leskin et al Washington NASA May 1971 6 p refs Transl. into ENGLISH from Energomashinostr. (Moscow), v. 16, Jul. 1970 p 45–46

(Contract NASw-2038)

(NASA-TT-F-13831) Avail: NTIS CSCL 20D

Experimental and theoretical study of the aerodynamic forces produced in a turbine stage by each subsequent vane cascade of a cascade series. Experimental oscillograms are given to show the pressure pulsations and pulsation amplitude variations on the concave and convex surfaces of a cascade sequence. The complex nature of variations in the aerodynamic forces resulting from the interaction between the successive vane cascades is discussed. Author

N71-26023*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

GAS JET IMPINGEMENT NORMAL TO A LIQUID SURFACE

Thomas L. Labus and John C. Aydelott Washington May 1971 16 p refs

(NASA-TN-D-6368; E-6211) Avail: NTIS CSCL 20D

An experimental and analytical investigation was conducted to determine the characteristics of a gaseous jet impinging normally on a liquid surface in regions where both gravitational and surface tension forces are significant. The surface penetration depths in the liquid resulting from a gas jet which exited from a circular aperture with an initially parabolic velocity profile were correlated in terms of a modified Weber number and a modified Bond number at ratios of nozzle liquid-surface distance to nozzle diameter ranging from 3 to 15. An expression was obtained for the limiting case of large modified Bond number, which is applicable to an environment where the gravitational force is dominant. Author

N71-26053*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

FLOW FIELDS AND AERODYNAMIC HEATING OF SPACE SHUTTLE ORBITERS

J. G. Marvin, W. K. Lockman, G. G. Mateer, H. L. Seegmiller, C. C. Pappas et al *In its* NASA Space Shuttle Technol. Conf., Vol. Apr. 1971 p 21–73 refs (See N71-26051 14-31)

Avail: NTIS HC $9.00/MF $0.95 CSCL 20D

Flow fields and heating environments that the space shuttle orbiter will encounter are investigated in hypersonic wind tunnel simulations in order to obtain data for evaluating performance prediction techniques and for extrapolating ground based facility data to flight conditions. Photographs of streamline oil flow patterns, pressure distribution data, and heating data on the windward surface of low and high cross-range orbiters are presented and comparisons with theory are made. G.G.

N71-26055*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

BOUNDARY LAYER TRANSITION AND HEATING CRITERIA APPLICABLE TO SPACE SHUTTLE CONFIGURATIONS FROM FLIGHT AND GROUND TESTS

Charles B. Johnson *In its* NASA Space Shuttle Technol. Conf., Vol. 1 Apr. 1971 p 97–156 refs (See N71-26051 14-31)

Avail: NTIS HC $9.00/MF $0.95 CSCL 20D

Boundary layer transition criteria and determination methods for boundary layer edge conditions using flight and ground test data are evaluated for their applicability to space shuttle configurations. The data are used in three transition correlations of a space shuttle trajectory for which the local flow properties on the shuttle are calculated by a real-gas variable entropy solution. Calculations of boundary layer edge conditions using variable entropy and a survey of flow fields indicate that oblique shock entropy can be used for shuttle configurations, both in flight and wind tunnel applications. G.G.

N71-26056*# Grumman Aerospace Corp., Bethpage, N.Y.

A NUMERICAL PROCEDURE TO CALCULATE THE INVISCID FLOW FIELD ABOUT A SPACE SHUTTLE ORBITER TRAVELING AT A SUPERSONIC/HYPERSONIC VELOCITY

B. Grossman, F. Marconi, Jr., and G. Moretti *In* NASA, Washington NASA Space Shuttle Technol. Conf., Vol. 1 Apr. 1971 p 157–184 refs (See N71-26051 14-31)

Avail: NTIS HC $9.00/MF $0.95

A technique for computing the complete inviscid, three dimensional flow field about a vehicle flying at supersonic speed at an angle of attack is reported. The flow field in the vicinity of the stagnation point at the nose of the body is determined using a three dimensional, time dependent blunt body program. The asymptotic steady state values of this flow field are then used as starting conditions for a supersonic, steady state numerical calculation. This computation utilizes a three dimensional, finite difference marching technique which determined the flow field downstream of the nose of the vehicle where the flow is supersonic. Within the physical model of an inviscid, perfect gas, the complete coupled calculation provides an approximation which uniformly converges to the exact solution. Agreement with experimental results is excellent and applications of the program are made for a typical shuttle orbiter delta lifting body configuration at angle of attack. Author

N71-26177# Purdue Univ., Lafayette, Ind. Project SQUID Headquarters.

DYNAMIC TENSILE FAILURE BY GLYCEROL

David C. Erlich, David C. Wooten, and Richard C. Crewdson Jan. 1971 31 p refs Prepared in cooperation with Stanford Research Inst.

(Contract N00014-67-A-0226-0005; Proj. SQUID)

(AD-720727; SQUID-TR-SRI-30-PU) Avail: NTIS CSCL 20/4

A tensile strain was induced in shock-loaded glycerol by the intersection of two rarefaction waves, one of which was caused by the partial reflection of a shock from an interface with octane, a material of lower shock impedance. The maximum tensile stress and the subsequent tensile stress relaxation due to void nucleation and growth were measured indirectly by a stress gage placed in the octane. The dynamic tensile strength of the glycerol was calculated to be about 0.25 kbar for an initial tensile stress rate on the order of 10 to the 7th kbar/sec. Calculations indicated that spherical voids in glycerol of between 0.01 and 10 microns in radius follow a viscous growth law under tensile strain, and computations using this growth law showed the influence of initial void radii, void number density, and strain rate upon the macroscopic stress history during cavitation. Several possible void nucleation mechanisms are discussed. Author (GRA)

N71-26178# Purdue Univ., Lafayette, Ind. Project SQUID Headquarters.

VELOCITY DISTRIBUTIONS OF SEVERAL GASES SCATTERED FROM HIGH TEMPERATURE SURFACES

A. Cassuto, S. Tang, and John B. Fenn Feb. 1971 20 p refs Prepared in cooperation with Yale Univ.

(Contract N00014-67-A-0226-0005; Proj. SQUID)

(AD-720726; SQUID-TR-PR-120-PU) Avail: NTIS CSCL 20/4

Polycrystalline surfaces of molybdenum, tungsten and rhenium at temperatures up to 2600K were exposed to free molecule flows of hydrogen, helium, nitrogen, oxygen and argon at Mach numbers up to 4 from a room temperature source. Time-of-flight measurements were made for molecules reflected in the surface normal direction. Apparent translational accommodation coefficients ranged from .01 for hydrogen on a hot surface to nearly unity for all gases on surfaces at room temperature. Author (GRA)

N71-26179# Purdue Univ., Lafayette, Ind. Project SQUID Headquarters.

SPECIES SEPARATION BY STAGNATION OF ARGON-HELIUM MIXTURES IN SUPERSONIC FLOW

John H. Chang and John B. Fenn Feb. 1971 18 p refs Prepared in cooperation with Yale Univ.

(Contract N00014-67-A-0226-0005; Proj. SQUID)

(AD-720725; SQUID-TR-PR-119-PU) Avail: NTIS CSCL 20/4

Measurements were made of the gas composition in the stagnation region of hemispherical probes immersed in supersonic flows of argon-helium mixtures. Substantial enrichment of heavy species was found at densities high enough that impact pressure measurements indicated no viscous enhancement. As densities (Reynolds numbers) were further decreased, enrichment of heavy species increased. A correlation is presented which describes the enrichment in terms of probe Knudsen number, free stream Mach number and free stream composition. Author (GRA)

N71-26219 Florida Univ., Gainsville.
A THEORETICAL INVESTIGATION AND EXPERIMENTAL VERIFICATION OF THE MIXING OF INSOLUBLE LIQUIDS
Robert Louis San Martin (Ph.D. Thesis) 1969 130 p
Avail: Univ. Microfilms Order No. 70-11756

The mixing of fluids in a confined cylindrical geometry similar to the configuration in modern rockets was studied. Mixing, the ratio of the mixed fluids to the total fluids present, was determined both analytically and experimentally for several simulated bulkhead failure modes, for various initial potentials and for several fluid combinations. Several analytical methods were proposed for studying the mixing phenomena. The experimental study developed techniques for measuring and procedures for analyzing the data. The two most powerful techniques employed to measure the mixing phenomena were the film analysis and the thermocouple grid analysis techniques. Both allowed the determination of the maximum depth of penetration and the time at which it occurs, the mixing profiles at any time and the volume of fluid that is actually mixed. Dissert. Abstr.

N71-26247# Naval Ship Research and Development Center, Annapolis, Md.
TURBULENT FLOW DRAG REDUCTION BY DILUTE POLY ETHYLENE OXIDE SOLUTIONS IN CAPILLARY TUBES
Ira Michael Felsen Mar. 1971 162 p refs
(AD-720688; NSRDL/A-8-717; NSRDC-3240) Avail: NTIS CSCL 20/4

The study was initiated to investigate turbulent flow drag-reduction by dilute poly(ethylene oxide) solutions in capillary tubes and thereby elucidate the mechanism of drag-reduction through interpretation of the experimental results. Flow through capillary tubes was chosen as a means to (1) obtain a large ratio of solid surface area to fluid volume, and (2) obtain high shear stresses at low Reynolds numbers. This allowed investigation of surface effects and polymer degradation as a function of a number of variables which are known to influence drag-reduction. Author (GRA)

N71-26280 North Carolina State Univ., Raleigh.
TRANSPORT OF NOBLE GASES IN POLY(METHYL ACRYLATE)
William Harold Burgess, Jr. (Ph.D. Thesis) 1970 183 p
Avail: Univ. Microfilms Order No. 70-12826

The permeability, diffusivity and solubility of He, Ne, Ar, and Kr were determined in poly(methyl acrylate), PMA, in a temperature range encompassing the glass transition temperature, T sub g. Activation energies for diffusion E sub p were higher above T sub g than below T sub g for all four penetrants in PMA and the structural isomer of PMA poly(vinyl acetate), PVA. The observed slow decrease in specific volume with time below T sub g for both PMA and PVA suggests that these glassy polymers contain regions in which the density is less than the equilibrium value. Analysis of penetrant solubility in PMA suggests that below T sub g the penetrants' molal volumes are larger than above T sub g. Also the enthalpies of mixing noble gases in PMA below T sub g tend to be exothermic, suggesting a specific interaction occurs between the polymer and penetrants. The solubility and volumetric data appear to be consistent with the hypothesis that the polymer below T sub g contains expanded, high free energy regions which preferentially absorb the diffusing penetrants. Dissert. Abstr.

N71-26271 North Carolina State Univ., Raleigh.
A TIME-DEPENDENT COMPUTATION METHOD FOR FLOWS ABOUT BLUNT BODIES WITH DISCONTINUOUS CURVATURES
John Le Roy Parker (Ph.D. Thesis) 1970 78 p
Avail: Univ. Microfilms Order No. 70-12832

A time dependent numerical technique is developed for solving the governing equations for a two-dimensional, frozen flow about a blunt body with discontinuous curvature. The numerical scheme treats the detached shock wave as a moving discontinuity while the equations governing the flow in the shock layer are solved by a modified Lax-Wendroff scheme. The results obtained from this analysis are compared with other analytical results and experimental data. Furthermore, the sensitivity of the numerical scheme to grid size and initial conditions is also discussed. Dissert. Abstr.

N71-26274 Georgia Inst. of Tech., Atlanta.
A STUDY OF THE BASE FLOW OF AN IDEAL DISSOCIATING GAS
Robert Kirkland Sigman (Ph.D. Thesis) 1970 169 p
Avail: Univ. Microfilms Order No. 70-11192

An analytical investigation of the effects of finite rate dissociation and recombination reactions on the base pressure for supersonic, two-dimensional, laminar flow is presented. The Chapman-Korst flow model and the ideal dissociating gas model are used. The problem considered has negligible initial boundary layer thickness. The reattachment region of the flow is assumed to be chemically frozen and isentropic. The recompression of the inviscid flow is assumed to be governed by the frozen oblique shock relations. The exterior inviscid expansion into a constant-pressure region is treated by the method of characteristics. All flow properties along the constant-pressure boundary are found to vary monotonically. The compression waves generated by the chemical reactions in the expansion fan reflect from the constant-pressure boundary as expansion waves, thus eliminating the possibility of a recombination shock wave. Dissert. Abstr.

N71-26286 California Univ., San Diego.
SPECTRAL ENERGY TRANSFER AND HIGHER-ORDER CORRELATIONS IN GRID TURBULENCE
Wen-Yuan Chen (Ph.D. Thesis) 1970 163 p
Avail: Univ. Microfilms Order No. 70-12448

The energy transfer spectra in locally isotropic grid turbulence were determined from measurements of a particular combination of third-order correlation functions. These direct measurements of the energy transfer spectrum were used to determine the extent of validity for grid turbulence of the dynamical equation for the three-dimensional energy spectrum in isotropic turbulence. The extent of applicability of the isotropic energy balance is consistent with the usual local isotropy criterion based on energy spectra alone. Two-point time correlations up to eight-order of longitudinal velocity fluctuations and two-point time correlations of lateral velocity fluctuations up to third-order were measured using linearized hot-wire anemometry, digital sampling, a high-speed digital computer, and the recently developed fast-Fourier transform method. Dissert. Abstr.

N71-26297 Houston Univ., Tex.
THE TRANSPORT OF GASES THROUGH POLYMERIC MEMBRANES
Spyros K. Evnochides (Ph.D. Thesis) 1970 252 p
Avail: Univ. Microfilms Order No. 70-11954

Equilibrium sorption isotherms for the system ethane-low density polyethylene are reported. The data cover the range 76 to −15 F and are fitted to an exponential in pressure equation by a nonlinear least squares technique. Integral diffusion coefficients for the same system are also reported and interpreted by a Fickian, concentration dependent diffusion model. An iterative computational procedure based on the Boltzmann approximation to the solution of the nonlinear diffusion equation is used to determine the constants for the diffusion coefficient-concentration relationship. The permeability isobars initially decrease with decreasing temperature, but at a sufficiently low temperature they exhibit a minimum and a subsequent increase. An alternate method for the measurement of the diffusion and solubility coefficients, based on the ultra low frequency cycling of the sorption cell pressure, is developed. Dissert. Abstr.

N71-26299 Brown Univ., Providence, R.I.
FLOW OF SUSPENSIONS THROUGH TUBES
Venkataramaiah Seshadri (Ph.D. Thesis) 1969 109 p
Avail: Univ. Microfilms Order No. 70-8789

The flow of neutrally buoyant suspensions of rigid spherical particles flowing through narrow tubes is investigated. Simultaneous measurements of concentration reduction, between reservoir concentration and average tube concentration, and apparent relative fluidity are made over a wide range of reservoir concentration, tube to particle diameter ratio, and flow rate. Experiments are also made with suspensions of rigid disks and the disks are found to behave as spheres of equivalent volume. Experimental results are applied to calculate wall layer thicknesses and velocity profile in the tube. The measurements are compared with the data for flow of whole blood and red blood cell suspensions through narrow tubes. It is concluded that cell deformability is responsible for the non-Newtonian behavior of apparent fluidity and larger concentration reductions in the case of red cell suspensions. Dissert. Abstr.

N71-26307# Rhode Island Univ., Kingston. Div. of Engineering Research and Development.
A SIMPLE NEW ANALYSIS OF COMPRESSIBLE TURBULENT TWO DIMENSIONAL SKIN FRICTION UNDER ARBITRARY CONDITIONS Final Technical Report, 1 Jul. 1969 - 30 Jun. 1970
F. M. White and G. H. Christoph Wright-Patterson AFB, Ohio AFFDL Feb. 1971 104 p
(Contract F33615-69-C-1525)
(AD-720267; AFFDL-TR-70-133) Avail: NTIS CSCL 20/4

A new approach is proposed for analyzing the compressible turbulent boundary layer with arbitrary pressure gradient. The new theory generalizes an incompressible study to account for variations in wall temperature and free-stream Mach number and temperature. By properly handling the law-of-the-wall in the integration of momentum and continuity across the boundary layer, one may obtain a single ordinary differential equation for skin friction devoid of integral thicknesses and shape factors. The new differential equation is analyzed for various cases. For flat plate flow, a new relation is derived which is accurate for adiabatic flow and reasonably good for flow with heat transfer. For flow with strong adverse and favorable pressure gradients, the new theory is in good agreement with experiment. The new theory also contains an explicity criterion for boundary layer flow separation.
Author (GRA)

N71-26387* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INSTRUMENT FOR MEASURING THE DYNAMIC BEHAVIOR OF LIQUIDS Patent
David G. Stephens and Clemans A. Powell, Jr., inventors (to NASA) Issued 21 Oct. 1969 5 p Filed 26 Jan. 1968 Cl. 73-301; Int. Cl. G01f23/00
(NASA-Case-XLA-05541; US-Patent-3,473,379; US-Patent-Appl-SN-700986) Avail: US Patent Office CSCL 20D

An instrument to determine the dynamic behavior of liquid in a tank is described including a pipe fixed to the tank and extending throughout its height. An inlet of the pipe allows liquid to enter the pipe. A tube placed inside the pipe carries a plurality of pressure transducers, one being exposed to the liquid in the tank, a second exposed to liquid within the pipe, and a third located at the end of the tube below the other transducers. Outputs from the transducers are computed, and indicate the simultaneous acceleration of the tank, the amplitude of liquid slosh in the tank, and the depth of liquid in the tank.
Official Gazette of the U.S. Patent Office

N71-26464 North Carolina State Univ., Raleigh.
A FINITE-DIFFERENCE SOLUTION OF THE VISCOUS COMPRESSIBLE LAMINAR FLOW THROUGH AXISYMMETRIC CHANNELS
John Anthony Blaisdell (Ph.D. Thesis) 1969 65 p
Avail: Univ. Microfilms Order No. 70-12818

Solutions to the equations describing the flow of viscous, compressible gas through slender axisymmetric channels are presented. The interest in such solutions arises in connection with the design of low density wind tunnels and of the small attitude control rockets on spacecraft. The governing equations were obtained from the Navier-Stokes equations by an order of magnitude analysis. There were three coupled nonlinear partial differential equations to solve. The equations were transformed to a new coordinate system by a modified von Mises transformation which automatically satisfied the continuity equation and eliminated the radial velocity from the remaining equations. The transformation also made it particularly easy to apply a finite-difference technique. The Crank-Nicholson finite-difference technique was used and the equations were solved by specifying the centerline and boundary conditions and solving for the remaining flow properties and the resulting channel shape. The procedure was used for a nozzle and the results obtained were in good agreement with experimental results.
Dissert. Abstr.

N71-26472 North Carolina State Univ., Raleigh.
AXIOMATIC FORMULATION OF A MIXTURE THEORY FOR REACTING FLUIDS
Ting Shu Chen (Ph.D. Thesis) 1970 77 p
Avail: Univ. Microfilms Order No. 70-12828

A thermodynamic theory for mixtures of fluids undergoing chemical reaction and diffusion simultaneously is presented. The general dynamical equations are postulated in integral forms for the entire mixture instead of each fluid separately. The restrictions imposed by the entropy inequality on the constitutive equations are discussed. The concept of equilibrium and stability is modelled with the temporal evolution of partial density governed by an evolution equation. The basic equations are derived for a reacting mixture of two fluids. A number of conclusions are made as a result of this formulation. The problem of propagation of plane harmonic waves in an infinite, homogeneous mixture of two fluids is examined. The dispersion relations of both the longitudinal and transverse waves are analyzed and solved numerically for certain limiting cases.
Dissert. Abstr.

N71-26473 Arizona State Univ., Tempe.
DUHAMEL'S THEOREM FOR TWO DIMENSIONAL UNSTEADY LAMINAR INCOMPRESSIBLE FLUID FLOW PROBLEMS WITH REGULAR AND NONREGULAR BOUNDARIES
Harry Kent Hepworth (Ph.D. Thesis) 1970 223 p
Avail: Univ. Microfilms Order No. 70-11884

The unsteady laminar incompressible flow of Newtonian fluids in constant area ducts is analyzed. The solution presented uses Duhamel's theorem for which both continuous and discontinuous time-varying pressure gradients are included, both periodic and nonperiodic. The duct shapes chosen are the rectangular, circular, and annular sector cross-sections. The solutions are also for an arbitrary initial velocity and time-varying pressure gradient. The results presented for the regular boundaries are exact solutions of the Navier-Stokes equations. A computer program was written which computes the velocity field for the arbitrary two-dimensional region using the eigenvalues, selected differential equation solution terms and boundary and internal points. The solution results are presented both in dimensional and dimensionless form and examples for the use of various time-varying pressure gradients in the solutions obtained are presented.
Dissert. Abstr.

N71-26476# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
ACCURATE CHARACTERIZATION OF THE HIGH PRESSURE

ENVIRONMENT
Edward C. Lloyd, ed. Mar. 1971 327 p refs Proc. of a Symp. held at Gaithersburg, Md., 14–18 Oct. 1968
(NBS-SPEC-PUBL-326) Avail: SOD $4.50

Problems and techniques for precise high pressure measurements and for temperature measurements at high pressures are discussed. Selections of reproducible and reversible fixed reference points on a pressure scale as indicated by phase changes are summarized. For individual titles, see N71-26477 through N71-26514.

N71-26477# Bell Telephone Labs., Inc., Murray Hill, N.J.
HYDROSTATIC PRESSURES OF 50 kBAR IN A PISTON CYLINDER DEVICE: MEASUREMENT OF PRESSURE AND CHARACTERIZATION OF THE PRESSURE MEDIUM
A. Jayaraman and R. G. Maines *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 5–9 refs (See N71-26476 14-12)
Avail: SOD $4.50

A method suited for making resistivity and other electrical measurements to 50 kbar hydrostatic pressure, using a conventional piston cylinder device, is described. In this method a Teflon cell is used to contain the pressure medium, which is a 1:1 mixture of n-pentane and isoamyl alcohol. After the fluid mixture freezes, further advance of the piston results in uniaxial stress. However, this can be readily relaxed by heating the medium to 70 C. The resultant isotropic pressure distribution stays when the pressure medium is cooled back to room temperature. The technique of probing the pressure distribution inside the cell, as well as pressure calibration procedure, are described. Author

N71-26479# Army Electronics Command, Fort Monmouth, N.J. Inst. for Exploratory Research.
CHARACTERIZATION OF THE BISMUTH I-II AND BARIUM I-II POINTS UNDER HYDROSTATIC PRESSURE
R. J. Zeto, H. B. Vanfleet, E. Hryckowian, and C. D. Bosco *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 25–34 refs (See N71-26476 14-12)
Avail: SOD $4.50

Hydrostatic pressure experiments were made which have new and important relevance to high-pressure calibration in both liquid and solid pressure systems for the bismuth I-II and barium I-II points on the high pressure scale. The bismuth I-II transformations were characterized and the mechanism of the solid state reaction was related to pressure calibration. The strain hysteresis commonly associated with the bismuth I-II point was shown to be invalid and was alternatively explained on the basis of a thermally activated nucleation and growth mechanism which was demonstrated to govern these transformations. With hydrostatic pressure, initiation of the bismuth I-II transformation was observed as a function of kinetic times as long as 15 hours while pressure and temperature were maintained constant. The transformation behavior was a function also of the microstructure, purity, and thickness of the sample. Under hydrostatic pressure the bismuth I-II equilibrium point was not midway between the initiation of the I-II and II-I transformations but, was located appreciably closer to the former transformation. The barium I-II point was measured at 56.27 kbar on the basis of a manganin gage under hydrostatic pressure. Author

N71-26482# Osaka Univ. (Japan). Dept. of Material Physics.
EQUIPMENT FOR GENERATING PRESSURES UP TO 800 KILOBARS
Naoto Kawai *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 45–48 refs (See N71-26476 14-12)
Avail: SOD $4.50

A type of high pressure apparatus has been developed which extends considerably the range of attainable very high static pressure. It consists basically of a sphere segmented into tapering truncated pistons. Hydrostatic pressures in the sample chamber in the centre of the sphere have reached 800,000 bars (11,600,000 psi). Some new and interesting results from high pressure studies are described. Author

N71-26481# California Univ., Livermore. Lawrence Radiation Lab.
EFFECT OF 2024 ALUMINUM ALLOY STRENGTH ON HIGH PRESSURE SHOCK MEASUREMENTS
M. van Thiel and A. Kusubov *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 125–130 refs (See N71-26476 14-12)
Avail: SOD $4.50

A shock wave technique is described by which wave profiles may be determined in metals. Piezo-resistive manganin gages were used to determine these profiles to 130 kbars in 2024 aluminum alloy. The data are consistent with the assumption that the Hugoniot is the hydrostat. A maximum of 28 kbars is obtained for the maximum yield strength on the release wave following the strongest shock. The derived loading-unloading curves in the pressure volume and pressure mass velocity planes indicate that errors of about 2 percent are produced by use of purely hydrostatic release paths. Author

N71-26512# Brigham Young Univ., Provo, Utah.
HIGH PRESSURE SCALE AS DETERMINED BY X-RAY DIFFRACTION TECHNIQUES UP TO APPROXIMATELY 100 kbar
H. Tracy Hall *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 303–306 refs (See N71-26476 14-12)
Avail: SOD $4.50

A tetrahedral X-ray diffraction press was used to simultaneously observe volume and electrical resistance transitions in solid samples. Shapes of resistance curves in the regions of fixed points occurring simultaneously with volume transitions established a one-to-one correspondence at pressures beyond 30 kbar for barium with an abrupt increase in electrical resistance at 70 kbar. The overall barium compressibility curve determined by X-ray diffraction matched a corresponding curve plotted from compression data quite well when a value of 59 kbar was selected for the barium transition pressure. It was concluded that the 79 kbar resistance and 59 kbar volume transition were one and the same and that the correct barium transition pressure was about 59 kbar. Subsequent high pressure X-ray diffraction analyses established resistance-volume change correspondences for transitions in tellurium, cesium, ytterbium, bismuth and other metals that have been used as fixed point pressure standards. G.G.

N71-26513# Chicago Univ., Ill. Dept. of the Geophysical Sciences.
PRESSURE INHOMOGENEITY: A POSSIBLE SOURCE OF ERROR IN USING INTERNAL STANDARDS FOR PRESSURE GAGES
John C. Jamieson and Bart Olinger *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 321–323 refs (See N71-26476 14-12)
(Contract ARPA SD-89; Grant NSF GA-1270)
Avail: SOD $4.50

Studies have been made on two intimate mechanical mixtures of NaCl and Nb having different compositions at high pressures using X-ray diffraction. A plot of relative compression volume densities for Nb versus NaCl showed a different curve for each of the two mixtures. Analysis and the consequences of this apparent violation of the criteria for an internal pressure gage are discussed. Author

N71-26515# Syracuse Univ., N.Y.
THE INTERACTION OF A TRAVELING NORMAL SHOCK FRONT WITH A TWO DIMENSIONAL HIGH TEMPERATURE FLUID ELEMENT
Roger Peter Hamernik (Ph.D. Thesis) June 1970 118 p refs
(Grant NSF GK-1980)
Avail: Issuing Activity

An experimental and analytical investigation conducted in a shock tube on the interaction of a reflected normal shock front with a two-dimensional highly heated, thin gaseous element is discussed. The heated gaseous element was generated at a predetermined time either by exploding a fine gauge copper wire or by an electrical discharge between two thin needle electrodes in the drift flow of the incident shock wave. The transient interaction phenomena were systematically recorded using two optical systems. Initially, spark interferometric and schlieren techniques were used to obtain single optical records of the interaction phenomena as well as that of the post-interaction dynamic behavior of the heated gaseous element. Subsequently, an alternate recording system was developed which involved the use of a high speed framing camera (22,000 pictures/sec.) to obtain from a single run of the shock tube, a sequence of approximately fifty time resolved interferograms of the entire interaction phenomena. Author

N71-26516# Northrop Corp., Hawthorne, Calif. Aircraft Div.
A WIND TUNNEL INVESTIGATION OF JETS EXHAUSTING INTO A CROSSFLOW. VOLUME 2: ADDITIONAL DATA FOR THE ONE JET CONFIGURATION
Lynn B. Fricke, Peter T. Wooler, and Henry Ziegler Wright-Patterson AFB, Ohio AFFDL Dec. 1970 508 p
(Contract F33615-69-C-1602)
(AD-720232; AFFDL-TR-70-154-Vol-2) Avail: NTIS HC $8.00/MF $0.95 CSCL 20/4

A low speed wind tunnel test of a four-foot diameter circular plate model was conducted to determine surface static pressure distributions; jet paths, and jet decay characteristics in the presence of a crossflow. Data were obtained for a one-jet configuration with the jet exiting at a number of angles to the plate and at various velocity ratios and sideslip angles. The report is the second of four volumes. The test model, instrumentation, test procedure, and reduction and accuracy of the test data were discussed in Volume 1. Author (GRA)

N71-26517# Northrop Corp., Hawthorne, Calif. Aircraft Div.
A WIND TUNNEL INVESTIGATION OF JETS EXHAUSTING INTO A CROSS FLOW. VOLUME 3: ADDITIONAL DATA FOR TWO-JET CONFIGURATIONS
Lynn B. Fricke, Peter T. Wooler, and Henry Ziegler Wright-Patterson AFB, Ohio AFFDL Dec. 1970 504 p
(Contract F33615-69-C-1602)
(AD-720233; AFFDL-TR-70-154-Vol-3) Avail: NTIS HC $8.00/MF $0.95 CSCL 20/4

A low speed wind tunnel test of a four-foot diameter circular plate model with up to three exhausting jets was conducted to determine surface static pressure distributions, jet paths, and jet decay characteristics in the presence of a crossflow. Two-jet arrangements were tested with the jets exiting normal to the plate for three different spacings between the two jets and at a number of velocity ratios and sideslip angles. Three-jet configuration data were obtained with the jets exiting normal to the plate for a number of velocity ratios and sideslip angles. As a result of this investigation, several conclusions are deduced pertaining to the interaction of multiple jets exhausting into a crossflow. The report is the third of four volumes. The test model, instrumentation, test procedure, and reduction and accuracy of the test data were discussed in Volume 1; The present volume contains additional data pertaining to the two-jet configurations. Author (GRA)

N71-26539# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HEAT AND MASS TRANSFER. VOLUME 1: HEAT AND MASS TRANSFER WITH INTERACTION OF BODIES WITH FLUID FLOWS [TEPLO- I MASSOPERENOS. TOM 1: TEPLO-I MASSOPERENOS PRI VZAIMODEISTVII TEL S POTOKAMI ZHIDKOSTEI I GAZOV]
A. V. Lykov et al 31 Dec. 1970 991 p refs Transl. into ENGLISH from the Russian
(AD-720738; FTD-HC-23-818-68) Avail: NTIS HC (Individually priced)/MF $0.95 CSCL 20/4

Contents: Hydrodynamics and heat exchange during fluid flow in the boundary layer; Some problems of the hydrodynamics of heat- and mass-transfer of bodies moving in a fluid; Gas dynamics and heat exchange in jet streams; Certain problems of gas dynamics and heat- and mass-exchange in a stream of rarefied gas; Hydrodynamics and heat transfer during the flow of a fluid in pipes; Heat transfer with natural convection; and Radiation heat transfer problems. GRA

N71-26548* Nortronics, Palo Verdes Peninsula, Calif.
GAS LOW PRESSURE LOW FLOW RATE METERING SYSTEM Patent
Robert T. McDonald, Robert J. Fagot, and James A. Roman, inventors (to NASA) Issued 19 Jan. 1971 5 p Filed 30 Sep. 1968 Cl. 73-194; Int. Cl. G01f1/00 Sponsored by NASA
(NASA-Case-FRC-10022; US-Patent-3,555,898; US-Patent-Appl-SN-763729) Avail: US Patent Office CSCL 20D

A gas low pressure, low flow rate meter finding particular application in respiration rate studies, is disclosed. It includes a tubular member connected in the path of air or oxygen, supplied to a user from an appropriate source. An exciter wire is located in the tubular member. As each burst of air or oxygen, inhaled by the user, first passes through the tubular member, turbulance is produced about the exciter wire resulting in an acoustic signal or tone. The tone propagates through an acoustic tube to a microphone which is located outside the tubular member. The microphone produces an electrical signal which is conditioned prior to being recorded or displayed. Official Gazette of the U.S. Patent Office

N71-26602 Brown Univ., Providence, R.I.
RADIATION DOMINATED COULETTE FLOW OF NONGRAY GASES
Hsiang-Cheng Kung (Ph.D. Thesis) 1969 108 p
Avail: Univ. Microfilms Order No. 70-8747

Couette flow is considered in the limiting case of a strongly radiating non-gray gas. Both the stationary and the moving walls are assumed to be specular or diffuse, isothermal, parallel surfaces a finite distance apart. Due to the assumed smallness of the conduction-radiation ratio, the flow field is separated into a main region which is radiation dominated and in which the temperature gradient is not large, and boundary layers at the walls where the temperature gradient is large and where both radiation and conduction are important. The methods developed in this work are applied to a two-level non-gray absorption coefficient model. Dissert. Abstr.

N71-26605 California Univ., Berkeley.
ELECTROGASDYNAMIC ENERGY CONVERSION
David Michael France (Ph.D. Thesis) 1969 117 p
Avail: Univ. Microfilms Order No. 70-13050

Experimental and theoretical results are presented for the external operating characteristics of an electrogasdynamic energy converter operating with air as the working fluid and utilizing a corona discharge. An analytical relation is derived for predicting the converter load current. Experimental data for the effect of corona input conditions on the performance of the energy converter is used as a basis of comparison of the present theory to two other relations for predicting load current. Comparison of results utilizing three conversion channel geometries are presented. Effects of fluid velocity, density, and mass flux on output characteristics are given.

Investigations on the electrogasdynamic experimental facility were performed at mass flow rates of the order of one lbm/min. The most favorable results were obtained from the abrupt expansion channel. Ratios of output electrical power to corona input power of 2.5 were obtained at a voltage amplification ratio of 10. Dissert. Abstr.

N71-28609 Brown Univ., Providence, R.I.
EFFECTS OF FREE STREAM TURBULENCE AND PRESSURE GRADIENT ON LOCAL SKIN FRICTION ON FLAT PLATE
Oener Arici (Ph.D. Thesis) 1969 98 p
Avail: Univ. Microfilms Order No. 70-8884

A theory by allowing a conduction through the base material, and under the basic assumption that the thin thermal boundary layer is entirely within the zone of constant shear rate, was developed and close agreement with experiments was found. The indirect measurements of the local skin friction coefficient were made and the combined effect of favorable pressure gradient and free-stream turbulence on the local skin friction coefficient was studied. The following results were observed: (1) the effect of free-stream turbulence on the local skin friction coefficient in a laminar boundary layer, with a zero pressure gradient is negligible, (2) free-stream turbulence has an unnoticeable effect on the local skin friction in a laminar boundary layer with a pressure gradient, the effect of pressure gradient being sizeable, and (3) free-stream turbulence has no effect on the local skin friction coefficient, in a turbulent boundary layer with (or without) a pressure gradient. Dissert. Abstr.

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N71-25627# Ghana Univ., Legon. Dept. of Physics.
STUDIES OF EQUATORIAL IONOSPHERIC PHENOMENA USING TRANSMISSIONS FROM ACTIVE SATELLITES Final Scientific Report, 1 May 1967 – 28 Feb. 1970
John R. Koster, W. L. Korfker, and D. Yeboah-Amankwah Mar. 1970 95 p refs
(Contract F61052-67-C-0027)
(AD-719872; AFCRL-70-0603) Avail: NTIS CSCL 4/1

Simultaneous recordings of signals from two synchronous satellites spaced a few degrees in longitude are analyzed for scintillation, and deductions made about ionosphere irregularities. The total electron content (TEC) of the ionosphere is measured by means of a polarimeter whose operation is described. The most distinctive feature found is a marked oscillation of the TEC in the post-sunset period. Author (GRA)

N71-25628# Kiruna Geophysical Observatory (Sweden).
MODEL CALCULATIONS OF TRAVELLING IONOSPHERIC DISTURBANCES IN THE IONOSPHERE APPLIED TO QUASI-PERIODICAL VARIATIONS OF THE IONOSPHERIC ELECTRON CONTENT Final Scientific Report, 1 Apr. 1967 – 30 Jun. 1970
Ludwik Liszka 12 Sep. 1970 50 p refs
(Contract F61052-67-C-0026)
(AD-719873; AFCRL-70-0660) Avail: NTIS CSCL 4/1

Calculations of variations of the electron density during the passage of gravity waves are presented. The obtained electron density variations are used for calculations of the electron content, as observed by means of an orbiting satellite. It is shown that by comparison of model calculations made for given wave parameters and given ionospheric conditions with the observed electron content variations, actual wave parameters of the gravity wave producing these variations may be estimated. Author (GRA)

N71-25629# Virginia Inst. of Marine Science, Gloucester Point.
A TIME SERIES FROM THE BEACH ENVIRONMENT-2
W. Harrison and L. E. Fausak Dec. 1970 100 p refs
(Contract N00014-70-C-0004)
(AD-719923; Rept-7) Avail: NTIS CSCL 8/3

Intensive sampling of beach variables was undertaken during a 30-day period in August and September, 1969, at Virginia Beach, Virginia. The purpose was to investigate the water table of a marine beach and to clarify the interaction of the water table and several process variables of the beach-ocean-atmosphere system. This report describes the methods of measurement and tabulates the values obtained for the following variables: breaker height, breaker period, trough-to-bottom depth in front of a breaking wave, breaker steepness, breaker power, position of the limit of swash run-up, position of the outcrop of the water table on the foreshore, slope of the foreshore, water table elevations in each of 13 wells, beach elevations, barometric pressure, rainfall, and still-water level. Author (GRA)

N71-25637# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.
A NEW APPROACH TO THE THEORY OF THE MAGNETOSPHERE
H. Alfven and C.-G. Fealthammar Dec. 1970 19 p refs
(Rept-70-28) Avail: NTIS

The solar wind magnetosphere interaction, usually discussed in hydrodynamic terms, is reconsidered from the point of view of electric fields and currents. A simple model of the transfer of solar wind energy to the magnetosphere is presented. The case of magnetic-field reversal at the magnetopause is discussed in terms of an idealized current-sheet model. The energy release by magnetopause and magnetotail currents depends on magnetic topology. Southward interplanetary magnetic field favors release of energy that may drive geomagnetic activity. Author (ESRO)

N71-25656# Uppsala Univ. (Sweden). Seismological Inst.
FREQUENCY-DEPENDENT AMPLITUDE-DISTANCE CURVE FOR P-WAVES FROM 87 DEG TO 110 DEG
James H. Ansell 5 Oct. 1970 31 p refs
(Contract F61052-69-C-0037; ARPA Order 292)
(AD-719874; AFCRL-70-0659; SR-21) Avail: NTIS CSCL 8/11

The work is an attempt to clarify the nature of the amplitude-distance curve for P-waves between 87 and 110 degrees, using the spectral amplitudes of earthquakes in the Indonesian region recorded at the Swedish and Finnish seismograph stations. At the present time the results are inconclusive, because even after allowing for station and source terms there is a large unexpected scatter. Author (GRA)

N71-25657# Naval Research Lab., Washington, D.C.
WAVE HEIGHT MEASUREMENT BY RADAR Interim Report
George F. Myers 1 Feb. 1971 15 p refs
(AD-719888; NRL-7231) Avail: NTIS CSCL 8/3

Wave heights were measured by the use of a slightly modified NRL X-band nanosecond-pulse test radar. This equipment, mounted above the surface and looking down, provided a precision that is equivalent to that obtained from a through-the-surface wave sensor. Stable platforms 20 to 60 feet above the surface gave excellent results, and a brief test made with a helicopter flying 100 feet up at 60 to 100 knots forward speed indicated possibilities for this platform. Targets with a periodic change in range, such as a swinging sphere, were studied. The combination of nanosecond radar techniques and fixed platforms for looking vertically at the

rough water surface permits wave heights to be measured in the open ocean where through-the-surface sensors are not practical. Author (GRA)

N71-25672# University Coll., London (England). Dept. of Physics.
IONOSPHERIC WINDS IN THE AURORAL ZONE
David Rees Oct. 1970 25 p refs
(Contract F61052-68-C-0057)
(AD-719876; SR-3; AFCRL-71-0085) Avail: NTIS CSCL 4/1

Observations of the drift velocity of rocket-borne chemical releases have been used to determine neutral wind velocity and ion velocity in the altitude range 90-230 km at ESRANGE, Kiruna. The ion cloud drift measurements have demonstrated the orthogonality of the simultaneous magnetic perturbation vector at ground level and the ion drift vector in the F region of the ionosphere. This result implies that in the auroral zone Hall currents are predominantly responsible for that part of the total magnetic perturbation seen at ground level due to ionospheric currents. A comparison of neutral wind velocity profiles obtained under quiet and disturbed geomagnetic conditions has shown that in the auroral zone the observed west-east neutral wind component above about 120 km altitude is directly correlated with the mean south-north magnetic perturbation vector over a period of two-three hours prior to the observations. This correlation is due to acceleration of the neutral atmosphere above 120 km by ions drifting in a meridional electric field. Both the ground magnetic perturbation and the neutral acceleration are direct functions of the locally magnetic perturbation and the neutral acceleration are direct functions of the locally enhanced electric field and of the electron (and hence ion) density. Author (GRA)

N71-25736*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVATIONS OF THERMOSPHERIC ION COMPOSITION ABOVE WALLOPS ISLAND DURING THE 7 MARCH 1970 SOLAR ECLIPSE
Merritt W. Pharo, III and Leighton R. Scott Mar. 1971 18 p refs Presented at the 52d Ann. Meeting of the Am. Geophys. Union, Washington, D.C., 12 Apr. 1971
(NASA-TM-X-65531; X-621-71-105) Avail: NTIS CSCL 04A

Two thermosphere probe positive ion mass spectrometers, launched 38 and 11 minutes before the March 7, 1970 a total eclipse of the sun from Wallops Island, measured the ion composition in the F-region from 130 to 290 kilometers altitude. These measurements were taken to investigate the thermal balance, photochemistry, and dynamic response of the charged and neutral constituents to changing solar conditions. Electrostatic probes measured the electron temperature and density, while the omegatron mass spectrometers measured the N2 temperature and density on the flights. The first measurement results of the ion spectrometer are presented and compared with theoretical predictions of the ion composition at totality during the eclipse. Author

N71-25746# Joint Publications Research Service, Washington, D.C.
STUDY OF CLEAR SKY TURBULENCE IN THE STRATOSPHERE
N. K. Vinnichenko et al 14 May 1971 12 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ. (Moscow), no. 100, 1970 p 86-98
(JPRS-53133) Avail: NTIS

Theoretical and experimental studies of clear air turbulence are reviewed. The topics include the following areas of investigations: large and small scale pulsations, statistical hydromechanical study of synoptic scale movements, characteristic features distinguishing turbulent motion from wave motion, turbulence affecting supersonic passenger and transport aircraft, energy transfer rate in the presence of turbulence, distribution of turbulent zones, correlation and spectral characteristics of lower stratospheric turbulence, and problems associated with creating a physical model of turbulence in the free atmosphere. N.E.N.

N71-25747*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TEMPORAL VARIATIONS OF THERMOSPHERIC HYDROGEN DERIVED FROM IN SITU MEASUREMENTS
Henry C. Brinton and Hans G. Mayr May 1971 13 p refs Submitted for publication
(NASA-TM-X-65544; X-621-71-185) Avail: NTIS CSCL 03B

Early results are presented of a correlative study of Explorer 32 data obtained in the period June 1966 through January 1967, in an altitude range of 280 to 450 km, and within a limited range of 23 deg to 47 deg latitude and -65 deg to -124 deg longitude. The atomic hydrogen concentration was derived from a chemical equilibrium equation containing measured ion composition and model n(O) values. The variation of n(H) between approximately 400,000 and 80,000/cu cm was resolved into density contribution associated with the primary exospheric temperature components. The most significant components are summarized as follows: (1) Solar cycle: The increase in average solar activity from 100 to 140 and resultant atmospheric temperature increase caused a factor of 2.5 decrease in n(H). (2) Solar rotation: The 27-day variation in solar activity and the corresponding temperature component were correlated with an inverse n(H) variation of as much as a factor of 1.3. (3) Diurnal: The concentration of hydrogen increased by approximately a factor of two between day and night, with a phase delay of about three hours between model exospheric temperature and n(H). Author

N71-25763# Texas A&M Univ., College Station. Dept. of Oceanography.
MARINE GEOLOGICAL AND GEOPHYSICAL RESEARCH AND EXPLORATION
Takashi Ichiye 1970 16 p refs
(Contract Nonr-2119(04); Grant NSF GA-13430)
(AD-720778) Avail: NTIS CSCL 8/7

Most of the major cruises of oceanographic research vessels include marine geological programs. The recent international cooperative survey programs were usually devoted to several phases of marine geology. Cruise tracks and research vessels used in major deep-sea expeditions during 1873 and 1960 are described by Wust. Author (GRA)

N71-25843# Woods Hole Oceanographic Institution, Mass.
MAGNETIC ANOMALIES IN THE RED SEA
J. D. Phillips Repr. From Phil. Trans. Roy. Soc. London, Ser. A (London), no. 267, 1970 p 205-217 refs
(Contracts N00014-16-C-0241; Nonr-4029(00))
(AD-718910; WHOI-Ref-71-10; WHOI-Contrib-2377) CSCL 8/7

Marine magnetic profiles over the Red Sea between 18N and 25N latitudes confirm hypotheses that strongly magnetic rocks underlie the axial trough. The symmetrical nature of the anomalies and their close correspondence to seafloor spreading magnetic models support a rifting origin for the trough. The dominant magnetic anomaly trends strike about N 35W in the northern and southern parts of the trough. In the central region between 20 and 22N the trend direction is about N 60 E. Geometrical considerations of possible spreading mechanisms suggest that the true separation direction of Africa away from Arabia near 21N latitude is in either a N 10 E or N 60 E direction. The separation rates then are 3.2 cm a-1 and 2.0 cm a-1, respectively. Author (GRA)

N71-25845# Lincoln Lab., Mass. Inst. of Tech., Lexington.
RAY TRACING IN ARBITRARILY HETEROGENEOUS MEDIA
Bruce R. Julian 31 Dec. 1970 23 p refs
(Contract F19628-70-C-0230; ARPA Order 512)

(AD-720795; TN-1970-45; ESD-TR-70-419) Avail: NTIS CSCL 8/11

The study of lateral variations of earth structure has been stimulated recently by several factors, especially the theory of plate tectonics and the increasing use of large seismic arrays. The extension of seismic ray theory to two and three dimensional structures is thus of great practical importance. The problem of ray tracing in a generally heterogeneous medium is treated, using the calculus of variations and Fermats principle of stationary time. The solution is expressed in terms of a system of five simultaneous first order differential equations giving the variation with time of the position and direction of motion of a point on a ray in terms of the wave speed and its spatial derivatives in the medium. If the earth model has certain symmetry properties, then constants of the motion along each ray can be found which simplify the calculations. The propagation of surface waves on an earth with geographical variations can be treated by a simplified special case of the method presented here. Author (GRA)

N71-25856# Arizona Univ., Tucson. Inst. of Atmospheric Physics.
CORONA PROCESSES IN CLOUDS Final Report
George A. Dawson 18 Mar. 1971 7 p refs
(Contract N00014-70-C-0358)
(AD-720771) Avail: NTIS CSCL 4/1

Work has continued on the basic discharge mechanisms of electrically stressed water surfaces. The purpose of the study is to elucidate the processes leading to the initiation of lightning strokes and the production of radio noise with or without lightning strokes by highly electrified clouds. In this latter phase of the investigation, measurements have been made of the sparking potential of gaps in low pressure air between two electrodes, the cathode of which was a plane water surface. All the work was conducted in the Townsend discharge regime. Author (GRA)

N71-25887# Aerospace Corp., El Segundo, Calif.
THE AEROSPACE CORPORATION SPACE SCIENCE PROGRAM REPORT TO COSPAR CY 1970
George A. Paulikas, comp. 15 Mar. 1971 22 p refs
(Contract F04701-70-C-0059)
(AD-720807; TR-0059(6260-01)-1; SAMSO-TR-71-49) Avail: NTIS CSCL 4/1

Results obtained during 1970 by the space research programs of The Aerospace Corporation are presented. The results are those of studies dealing with the physics of the upper atmosphere and the magnetosphere and solar and stellar physics. Author (GRA)

N71-25888*# Computer Sciences Corp., Falls Church, Va.
SPACECRAFT OCEANOGRAPHY: PROJECT DOCUMENTATION STUDY Final Report
William L. Vest and B. D. Claggett Nov. 1970 324 p refs
(NASA Order W-12879; Contract N62306-70-C-0149)
(NASA-CR-118644) Avail: NTIS HC$6.00/MF$0.95 CSCL 08J

Results of the study on the acquisition of oceanographic information by spaceborne instruments and the utilization of the data are presented. The users, both real and potential, are identified, and their information requirements are documented. Progress made towards sensing the phenomena and utilizing the data, and the overall status of remote sensing of oceanographic parameters are discussed. The information management systems and the potential benefits are described. Author

N71-25889# Smithsonian Institution, Washington, D.C.
NATIONAL AND INTERNATIONAL ENVIRONMENTAL MONITORING ACTIVITIES: A DIRECTORY
Oct. 1970 309 p
Avail: Smithsonian Inst. Center for Short-Lived Phenomena, 60 Garden St., Cambridge, Mass. 02138: $10.00

Basic information is presented on the number, global distribution, and operational characteristics of existing and planned environmental monitoring activities. Information is given on international activities and national activities in 133 countries. The national program data are broken down into astrophysical, biological, geophysical, hydrological, meteorological, oceanographic, and seismological sections. Maps of the station distribution within the monitoring networks are included whenever possible. Author

N71-25890# Lockheed Missiles and Space Co., Palo Alto, Calif.
ANALYSIS OF THE N(z) PROFILE OF THE UPPER IONOSPHERE FROM DATA OF VERTICAL PROBING FROM THE EARTH'S SURFACE
S. M. Slutsker [1971] 3 p refs Transl. into ENGLISH from Geomagn. Aeron. (Moscow), v. 11, no. 1, 1971 p 157–159
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

An approximation method is developed for determining the ionization profile of the upper ionosphere in terms of lower ionosphere parameters. The electron concentration profiles obtained from Alouette 1 data were used to describe the shape of the upper ionosphere, and the theoretical calculations of the upper ionosphere profile were compared with experimental results obtained from geophysical rockets. N.E.N.

N71-25959# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ATMOSPHERIC TURBIDITY CHARACTERISTIC AS A CONSEQUENCE OF GENERAL STATISTICAL REGULARITIES
L. G. Makhotkin 25 Nov. 1970 9 p refs Transl. into ENGLISH from Tr. May 1968 Aktinometriya i Optika Atm. Sednaya Mezhvedomstvennaya Soveshch. po Aktinometrii i Optike Atm. (Leningrad), 1969 p 284–287
(AD-720364; FTD-HT-23-834-70) Avail: NTIS CSCL 4/1

The author discusses the need to reexamine certain concepts in actinometry. The widespread acceptance of Linke's erroneous definition of the turbidity factor is attacked. Author (GRA)

N71-25960# Aerojet-General Corp., El Monte, Calif. Microwave Div.
MICROWAVE EMISSION CHARACTERISTICS OF NATURAL MATERIALS AND THE ENVIRONMENT: A SUMMARY OF SIX YEARS RESEARCH Final Technical Report, 8 Jan. 1965–15 Feb. 1971
A. T. Edgerton, F. Ruskey, D. Williams, A. Stogryn, and G. Poe Feb. 1971 304 p refs
(Contract N00014-70-C-0351)
(AD-720388; AGC-9016R-8) Avail: NTIS CSCL 8/13

The document is the eighth and final technical report of the series. It summarizes six years of basic and applied research into the microwave emission characteristics of natural materials and the environment. Research activities encompass investigations of the ocean and coastal environment, snowpack and ice studies, sediment and soil studies, dielectric constant measurements and techniques, and analytical modeling of natural materials and the environment. Field studies were conducted with a mobile microwave field laboratory containing a number of microwave radiometers and supporting instrumentation. Oceanographic research has been concerned with the effects of microwave emission of ocean surface roughness, water temperature, salinity, and surface pollutants. Hydrologic studies were concerned with the physics of microwave emission by snowpacks, fresh and sea ice. Other investigations have been concerned with the emission characteristics of sediments and soils and the determination of soil moisture content with microwave radiometry. The report also provides a detailed account of the current years research which entails multiwavelength microwave radiometric measurements and numerical modeling of controlled, small scale waves. Author (GRA)

N71-25966# Joint Publications Research Service, Washington, D.C.

MARINE HYDROPHYSICAL RESEARCH

29 Apr. 1971 72 p refs Transl. into ENGLISH from Morsk. Gidrofiz. Issled. (Sevastopol), no. 1, 1970 p 98–124, 192–202, and 236–272

(JPRS-53004) Avail: NTIS

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1. SPECTRA OF GAMMA-RADIATION OF SEA WATER OF CONSTANT SALT COMPOSITION A. S. Venogradov et al p 1–9 refs (See N71-25967 13-14)

2. A STUDY OF BOUNDARY LAYERS OF THE ATMOSPHERE AND OCEAN A. G. Kolesnikov et al p 10–25 refs (See N71-25968 13-14)

3. RADIOACTIVITY OF THE NEAR-WATER ATMOSPHERE IN THE OPEN OCEAN AFTER THE PARTIAL CESSATION OF NUCLEAR WEAPON TESTS A. D. Zemlyanoy et al p 26–35 refs (See N71-25969 13-14)

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5. PROTON MAGNETOMETER FOR GEOMAGNETIC SURVEY IN THE OCEAN N. N. Karnaushenko et al p 43–49 refs (See N71-25971 14-14)

6. COMPLEX AUTOMATION OF COLLECTION AND PROCESSING OF DATA ON OCEAN FLOOR TOPOGRAPHY R. Kh. Greku et al p 50–61 refs (See N71-25972 13-14)

7. THE JOINT SOVIET-FRENCH INVESTIGATIONS IN THE NORTHWESTERN PART OF THE MEDITERRANEAN SEA A. G. Kolesnikov et al p 62–71 (See N71-25973 13-14)

N71-25967# Joint Publications Research Service, Washington, D.C.

SPECTRA OF GAMMA RADIATION OF SEA WATER OF CONSTANT SALT COMPOSITION

A. S. Vinogradov et al *In its* Marine Hydrophys. Res. 29 Apr. 1971 p 1–9 refs (See N71-25966 14-13)

Avail: NTIS

A method is described for calculation of dispersed gamma-radiation spectra in sea water having constant salt composition from two supporting spectra, i.e., for pure water and sea water of mean salinity. It is shown that salinity and density of sea water exert influence only through their relative changes. The formulas developed have a high degree of accuracy. Author

N71-25968# Joint Publications Research Service, Washington, D.C.

A STUDY OF BOUNDARY LAYERS OF THE ATMOSPHERE AND OCEAN

A. G. Kolesnikov et al *In its* Marine Hydrophys. Res. 29 Apr. 1971 p 10–25 refs (See N71-25966 14-13)

Avail: NTIS

A review of experimental research on turbulent structure of boundary layers of the atmosphere and ocean carried out at the Marine Hydrophysical Institute of the Ukrainian Academy of Sciences during recent years is given. Based on analysis of results of investigations a number of distinctive features of the field of wind velocity in the near-water layer of the atmosphere and the field of velocity in the upper agitated layer of the ocean are given. An attempt is made to understand the mechanism of interaction between boundary layers of the ocean and atmosphere. Author

N71-25969# Joint Publications Research Service, Washington, D.C.

RADIOACTIVITY OF THE NEAR WATER ATMOSPHERE IN THE OPEN OCEAN AFTER THE PARTIAL CESSATION OF NUCLEAR WEAPON TESTS

A. D. Zemlyanoy et al *In its* Marine Hydrophys. Res. 29 Apr. 1971 p 26–35 refs (See N71-25966 14-13)

Avail: NTIS

The concentration of artificial radionuclides in the near-water layer of the atmosphere, their isotope composition and density of fallout on the ocean surface are analyzed. An estimate of space distribution of artificial radionuclides in the near-water layer of the atmosphere over the period from 1962 to 1968 is given. Author

N71-25970# Joint Publications Research Service, Washington, D.C.

APPARATUS MODELING OF HYDROPHYSICAL FIELDS

V. S. Gladkiy et al *In its* Marine Hydrophys. Res. 29 Apr. 1971 p 36–42 refs (See N71-25966 14-13)

Avail: NTIS

Probability models for solution of equations of elliptic and parabolic type are discussed. Time of solution of boundary value problems by methods of direct and back wandering is estimated. A block-diagram of a specialized computing device is given. Author

N71-25972# Joint Publications Research Service, Washington, D.C.

COMPLEX AUTOMATION OF COLLECTION AND PROCESSING OF DATA ON OCEAN FLOOR TOPOGRAPHY

R. Kh. Greku et al *In its* Marine Hydrophys. Res. 29 Apr. 1971 p 50–61 refs (See N71-25966 14-13)

Avail: NTIS

The complex of automation for studying the ocean floor topography is described. The complex includes a system for automatic collection of navigational data and depth values as well as a program for processing of sounding data on the Minsk-22 electronic computer. Author

N71-25973# Joint Publications Research Service, Washington, D.C.

THE JOINT SOVIET-FRENCH INVESTIGATIONS IN THE NORTHWESTERN PART OF THE MEDITERRANEAN SEA

A. G. Kolesnikov et al *In its* Marine Hydrophys. Res. 29 Apr. 1971 p 62–71 (See N71-25966 14-13)

Avail: NTIS

The field studies carried out during the 23rd cruise of the RV Mikhail Lomonosov under the joint Soviet-French program are presented. Brief information on some preliminary scientific results of the performed works is given. Author

N71-26024# Texas Univ. Austin. Atmospheric Science Group.

THE NOCTURNAL URBAN HEAT ISLAND IN AUSTIN, TEXAS

John L. Wood May 1971 62 p refs

(Grant NSF-GA-16822)

(Rept-28) Avail: Issuing Activity

The existence of an urban heat island in Austin, Texas, on twelve evenings during the period from August through December, 1970, is presented. Data were obtained from thermistors mounted on two automobiles and from nine hygrothermographs in instrument shelters distributed throughout the city. Charts displaying the urban temperature distribution on each of the traverses and a composite average of all twelve are presented. Causative factors which were treated qualitatively and graphical comparisons of those permitting semi-quantitative treatment revealed heat islands more pronounced under clear skies, 7 or 8 knot winds, cold temperatures, low relative humidity, and high electrical power production. Author

N71-26106# Army Engineer Nuclear Cratering Group, Livermore, Calif.

PROJECT PRE-GONDOLA 2 Summary Report
W. C. Day, ed. Feb. 1971 125 p refs
(AD-720602; PNE-1112) Avail: NTIS CSCL 18/3

Contents: Description of Pregondola 2 experiment; Crater measurements and ejecta studies; Surface motion measurements; Geologic and engineering properties investigations; Seismic studies; Close-in airblast; Cloud development studies; Biological monitoring. GRA

N71-26184# Naval Ordnance Lab., White Oak, Md.
THE DEEP OCEAN OPTICAL MEASUREMENT (DOOM) PROGRAM Summary Report, Jul. 1967 - Jan. 1970
Donald E. Matlack 18 Jan. 1971 73 p refs
(AD-720685; NOLTR-70-165) Avail: NTIS CSCL 8/10

A shipborne system is described and results of in-situ measurements of the inherent optical properties of ocean water are presented. This Deep Ocean Optical Measurement (DOOM) system is designed to measure to any depth in the ocean spectral attenuation coefficients from 380 to 560 millimicrons, the volume scattering function at 436 millimicrons through an angular range from six to 92 degrees, and background illumination of both celestial and biological origin. Representative data obtained from December 1967 through January 1970 on six measurement cruises to various areas of the Atlantic are presented. Future cruises and plans are discussed. Author (GRA)

N71-26200# Committee on Commerce (U. S. Senate).
A READER IN INTERNATIONAL ENVIRONMENTAL SCIENCE
Washington GPO May 1971 164 p refs Presented to 91st Congr., 1st Sess., 18 May 1971 Prepared by Library of Congr. Environ. Policy Div. for Comm. on Com. (U. S. Senate) and Comm. on Sci. and Astronaut. (U. S. House) *Its* Serial B
Avail: Comm. on Sci. and Astronaut.

International concern is expressed for the quality and productivity of the environment. Major problem areas, the status of cooperative programs, and opportunities for future research are examined. J.A.M.

N71-26263# Tennessee Univ., Knoxville.
EVALUATION OF REMOTE SENSOR IMAGES, ASHEVILLE BASIN AREA, NORTH CAROLINA
Lyman O. Williams Dec. 1970 154 p refs Prepared in cooperation with East Tennessee Univ.
(Contract F19628-69-C-0116)
(AD-719761; Scientific-1; AFCRL-71-0015) Avail: NTIS CSCL 14/5

Isopleth mapping, computation of Piersons Correlation Coefficient, and multiple linear regression analysis have been employed to analyze the system: water-vegetation-soil-rock-topography in a 50 mile long, 12 mile wide area centered on Asheville, North Carolina. Comparison of data suggests that analysis of the 100 random samples give results which are comparible to isopleth mapping of 196 sample sites for variables which have relative abundance and which have relatively contrasting properties of weathering, erodability and water retention. These variables are clay and silt in soils, quarts in soils, potassium feldspar in soils and bedrock, garnet in soils, biotite in both soils and bedrock, and muscovite in bedrock, and they appear to be dependent on a unique combination of independent variables. Accordingly it appears that lowlands (Case A) will be more likely to have clay rich soils, with relatively longer channel lengths per square mile, and to have soils which have low color values and relatively more soil moisture. The subsurface is likely to have abundant muscovite or biotite in both soils and bedrock, and garnet will be associated. Author (GRA)

N71-26267# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATING THE DECODABILITY OF SMALL TOPOGRAPHIC OBJECTS IN LARGE-SCALE AERIAL PHOTOGRAPHY
L. M. Goldman 11 Jan. 1971 17 p refs Transl. into ENGLISH from Tsentr. Nauchn.-Issled. Inst. Geod., Aerosemki i Kartografii, Tr. (Moscow), no. 149, 1964 p 127 - 139
(AD-720765; FTD-HC-23-671-70) Avail: NTIS CSCL 14/5

Studies of the recognizability of small topographic objects in various types of large-scale aerial photographs were conducted for the purpose of establishing to what extent the application of each of their types increases the possibility of an office and field type decoding and permits a reduction in the ground-based pre-surveying of the objects not reflected during the aerial photographing in the scales governed by the instructions. Experimental studies were conducted in a wooded region where the recognizability of the small topographic objects is minimal, and in an open populated region where the concentration of such objects is fairly high. Author (GRA)

N71-26288# Air Force Cambridge Research Labs., Bedford, Mass.
A NUMERICAL STUDY OF THE SEASONAL AND SOLAR CYCLE CHANGES OF THE MID-LATITUDE NEUTRAL AIR WINDS
Charles M. Rush and John A. Pustaver 9 Dec. 1970 31 p refs *Its* Environ. Res. Papers No. 346
(AD-720247; AFCRL-70-0725) Avail: NTIS CSCL 4/1

The coupled equations representing the horizontal neutral air winds arising from the diurnal variation of atmospheric pressure, are solved numerically. Taking full account of the diurnal and seasonal variation of electron density, meridional and zonal winds have been computed at mid-latitudes for both solar maximum and solar minimum conditions. The daily variation of both the meridional and zonal wind can be well represented by a daily mean plus a 24- and 12-hour oscillation and tabular values of the winds for each season are given for the height of the F2 maximum and for every 100 km interval from 200 to 500 km. These values can be used to readily compute the associated vertical drift velocity at any middle latitude location when account is taken of the local geomagnetic field. Author (GRA)

N71-26300*# California Univ., Berkeley. Space Sciences Lab.
POWER SPECTRA OF THE MAGNETOSPHERIC ELECTRIC FIELD
Forrest S. Mozer 5 Jan. 1971 58 p refs *Its* Space Sci. Lab. Ser. 12, Issue 1
(Contracts NAS9-9502; NAS5-10362; N00014-69-A-0200-1015; Grants NSF GA-1317; NSF GA-11259; NSF GA-17328; Proj. NR 021-213)
(NASA-CR-118343; AD-717350) Avail: NTIS CSCL 04A

Fluctuations of the magnetospheric electric field with periods between one minute and one day have been studied by analyses of more than 200 power spectra generated from about 700 hours of electric field data obtained by flight of 44 balloons at sites ranging in L from 2.8 to 23. Results are discussed. GRA

N71-26316*# Geological Survey, Washington, D.C.
SATELLITE PHOTOGRAPHY AS A GEOGRAPHIC TOOL FOR LAND USE MAPPING OF THE SOUTHWESTERN UNITED STATES Technical Report, 1 Jul. 1968 - 31 Jan. 1970
Norman J. W. Thrower (Calif. Univ., Los Angeles), Leslie W. Senger (Calif. Univ., Los Angeles), Robert H. Mullens, II (Calif Univ., Los Angeles), and Keith J. Walton (Calif. Univ., Los Angeles) Jan. 1970 22 p refs Prepared by Assoc. of Am. Geographers
(NASA Order W-12572)
(NASA-CR-118518; USGS-193; TR-69-3) Avail: NTIS CSCL 08E

The utility of satellite photography for generalized land use mapping at intermediate and small map scales was investigated. Photography of the southwestern United States from the Gemini and Apollo missions was used to determine what land uses are visible on satellite photography, devise a land use classification system compatible with data obtainable from such imagery, and construct land use maps at scales of 1:250,000 and 1:1,000,000. Various land use categories are interpretable from the photography, although some are difficult to distinguish (e.g., unimproved grazing land and woodland). Accuracy was found to be a function of the degree of dependence on spectral characteristics and the consequent amount of inference necessary for an interpretation. The photography proved a useful data source when supplemented by limited field investigations and the geographical knowledge of the investigators. Author

N71-26317# Joint Publications Rsearch Service, Washington, D.C.

AIDS TO OCEANOGRAPHIC RESEARCH

T. A. Zorina, ed. 11 May 1971 115 p refs Transl. into ENGLISH from the book 'Sovremennaya Apparatura Dlya Okeanografischeskikh Issledovaniy' Sevastopol, Marine Hydrophys. Inst. of Ukr. SSR Acad. of Sci., 27 Mar. 1970 p 88-192

(JPRS-53090) Avail: NTIS

Oceanographic equipment and methods are described for measuring the radioactivity and magnetic fields in the sea water. Autonomous measuring complexes and shipboard information systems are discussed as well as the equipping of manned self-propelled devices for oceanographic research. J.M.

N71-26360*# Bellcomm, Inc., Washington, D.C.

MULTIPLE SCATTERING CALCULATIONS: GEOMETRY FOR SPHERICAL ATMOSPHERES

E. N. Shipley 16 Apr. 1971 45 p

(Contract NASw-417)

(NASA-CR-118662; TM-71-1011-5) Avail: NTIS CSCL 03B

The geometric relationships are described that arise in carrying out atmospheric calculations for a spherical planet. These relationships were developed for the specific case of light scattering from a planetary atmosphere or haze. However, the geometrical relationships are of general use in a wide range of problems that involve a spherical surface. Descriptions are given of: (1) the multiple scattering problem and the approximation procedure used to solve the problem, (2) the coordinate system and symmetries used, and (3) the relationships among the variables. In addition, an analysis of the shadow region is presented including a subroutine for carrying out the shadow calculations. D.L.G.

N71-26372# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.

METEOROLOGICAL INFLUENCE OF A SOLAR ECLIPSE ON THE STRATOSPHERE

J. S. Randhawa, B. H. Williams, and M. D. Kays Ft. Monmouth, N.J. ECOM Dec. 1970 54 p refs

(AD-720199; ECOM-5345) Avail: NTIS CSCL 4/1

An experiment to study the influence of a solar eclipse on the earths lower atmosphere was conducted at Eglin Air Force Base, Florida, where a solar eclipse occurred on 7 March 1970. Three temperature-ozonesondes and eight Arcasondes were deployed into the upper stratosphere and lower mesosphere at times prior to, during, and after the total eclipse. In addition, two electrochemical ozonesondes were flown on balloons on 5 and 6 March. Resulting temperature, wind and ozone ata are presented. No measurements were made during the totality. An increase in ozone was measured during and several hours after the partial eclipse. Higher temperatures and a perturbation in the zonal wind field were observed in the middle stratosphere during the partial eclipse. Author (GRA)

N71-26373# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE INTERACTION OF SHOCK WAVES IN WATER SATURATED EARTH AND IN WATER

G. M. Lyakhov 18 Dec. 1970 13 p refs Transl. into ENGLISH from Akademiya Nauk (SSSR), no. 1, 1961 p 155-158

(AD-720757; FTD-HT-23-872-70) Avail: NTIS CSCL 8/11

On the basis of an approximation of the dependence p(V) by a piecewise linear function the author gives an approximate solution to the problem of the interaction of a two-dimensional nonstationary shock wave with the boundary of media, a shifted boundary, and with a boundary of a region of given pressure. Author (GRA)

N71-26378# Texas Univ., Austin. Dept. of Mechanical Engineering.

USE OF NEW ANALYTICAL METHODS IN WATER RESOURCE DEVELOPMENT

C. S. Beightler Sep. 1970 22 p refs

(Grant DI-G-16110-FZE)

(Rept-09/70) Avail: Issuing Activity

The interacting effects which exist between each reservoir and all downstream reservoirs are the predominant characteristics to be considered in the design of a system of reservoirs in any river basin. For the purpose of formulating a mathematical model for this type of problem, a number of recently developed optimization techniques were studied. The best formulation was found to be that which treated the reservoir system design as a branched multistage decision process. In such processes, the decisions made at each stage (potential reservoir site) affect the circumstances under which all subsequent decisions in the system must be made. The intercoupled staging structure of this process was then exploited by means of the nonserial dynamic programming algorithms developed in the course of this research project. These algorithms are effectively decomposition techniques which break down the nonserial process into an equivalent serial process that is amenable to solution through ordinary dynamic programming methods. Author

N71-26379# California Univ., Los Angeles. Graduate School of Business Administration.

MATHEMATICAL PROGRAMMING FOR REGIONAL WATER QUALITY MANAGEMENT

Glenn W. Graves, Andrew B. Whinston, and Gordon B. Hatfield Aug. 1970 134 p refs

(Grant DI-G-16110-FPX)

(Rept-08/70) Avail: SOD $1.25

A nonlinear programming algorithm is applied to the problem of optimal water quality control in an estuary. The mathematical model gives the solution to the general mixed case of at-source treatment, regional treatment plants, and by-pass piping. The nonlinear algorithm is developed in considerable detail and a sample problem is worked out. Detailed results are presented for a pilot problem to illustrate the method of solution. Actual data from the Delaware Estuary is used to solve a large scale problem and the solution is given. The results indicate that a regional treatment system for the Delaware Estuary is superior, in terms, of total cost, to other proposed schemes. Author

N71-26398*# Transportation Systems Center, Cambridge, Mass.

EARTH SURVEY BIBLIOGRAPHY: A KWIC INDEX OF REMOTE SENSING INFORMATION

William I. Thompson, III Feb. 1971 269 p refs Sponsored by NASA

(NASA-CR-118489; DOT-TSC-NASA-70-1) Avail: NTIS CSCL 08G

A collection of 1650 bibliographic citations on remote sensing of the physical characteristics of the earth is presented. The

bibliography is intended to be used as a source document leading to additional information. Author

N71-26457# Joint Publications Research Service, Washington, D.C.
CHANGES OF THE NATURE OF THE EARTH'S SURFACE IN THE LATEST GEOLOGICAL EPOCH
K. K. Markov *In its* Vestn. of the USSR Acad. of Sci., Vol. 40, No. 6, 1970 31 Aug. 1970 p 113-121 (See N71-26452 14-30)
Avail: NTIS

The general trend of change in climate in the last million years is expressed in a growing planetary cooling and a corresponding change of the entire organic and inorganic world. Climatological dryness is intensified. Also reported are changes in configurations and heights of the continents and in the depths of the oceans. Changes of climate affected all components of nature and expressed themselved differently at different regions of terrestrial space. The possible warming of the Arctic by human effects causes complex changes in nature to the south. G.G.

N71-26459# Joint Publications Research Service, Washington, D.C.
PROBLEMS OF TROPICAL WEATHERING (SYMPOSIUM IN INDONESIA)
V. M. Fridland *In its* Vestn. of the USSR Acad. of Sci., Vol. 40, No. 6, 1970 31 Aug. 1970 p 133-137 refs (See N71-26452 14-30)
Avail: NTIS

Reported studies concentrate on the mechanism of weathering and its connection with soil formation and the use of soils. Profiles of principle tropical soils are considered and the processes of their formations and transformations as results of hydrolysis, silification and crystallization are discussed. It is shown that the quantity of electrically negative bonds in a mineral determines its reaction with polarized molecules of water; therefore, minerals of certain systems of silicates have a susceptibility to weathering inversely proportional to their SiO2 content. G.G.

N71-26641# Coast and Geodetic Survey, Rockville, Md.
WAVE REPORTING PROCEDURES FOR TIDE OBSERVERS IN THE TSUNAMI WARNING SYSTEM
M. G. Spaeth Jun. 1970 48 p Revised
(COM-71-00170; C/GS-PUB-30-3-REV) Avail: SOD $0.50 CSCL 08C

General information and specific instructions are given to aid tide observers in reporting tsunamis. The instructions supersede Coast and Geodetic Survey Publication 30-3 (1966) and all tsunami-reporting instructions issued pursuant thereto. Author (GRA)

N71-26623# Joint Publications Research Service, Washington, D.C.
GLOBAL CONTAMINATION OF THE ATMOSPHERE BY KRYPTON-85 FROM WORLD WIDE NUCLEAR POWER PLANTS AND THE RADIATION DANGER
I.L. Karol et al 20 May 1971 17 p refs Transl. into ENGLISH of the publ. 'Globalnoye Zagryazneniye Atmosfery Kriptonom-85 ot Mirovoy Yadernoy Energetiki i Yego Radiatsionnaya Opasnost' Obninsk, Inst. of Expt. Meteorology p 1-25
(JPRS-53174) Avail: NTIS

The annual mean and zonally avesaged concentration of krypton-85 in the troposphere and lower stratosphere of the Northern and Southern hemispheres are calculated. The calculations are based on a numerical deviation of a global spread of the admixture in a meridional plane of the atmosphere. The results of the calculations with various combinations of the transfer parameters of the model are compared with the results of measurements in the U.S. and abroad. Predicted distributions of the expected levels of the gas were obtained up to the year 2,000. The corresponding radiation dose strengths in the air for the whole body and for individual organs of the human body were also calculated. These dose strengths and concentrations are compared with the maximum allowable levels which were established on the basis of the current recommendations of the International Commission for Radiological Defense and Medical Rules. Author

N71-26625# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
IONOSPHERIC DATA
Asheville, N.C. Natl. Climatic Center May 1971 152 p
(NOAA-ISPDA-FA-321) Avail: SOD $1.00

Monthly data from the worldwide network of observatory ionospheric vertical sounding stations as reported to World Data Center A are given. These data describe the climatology of the ionosphere as measured by ionosondes. The data tables give the monthly median and other statistics for each hour of the day for the principle characteristics derived from ionograms. The graphs illustrate the diurnal variations of the medians of foF2, foF1, foE, and foEs in the lower section and of M(3000)F2 in the upper section. E.H.W.

N71-26644# Geological Survey, Washington, D.C.
GEOLOGICAL SURVEY RESEARCH 1970, CHAPTER D
1970 321 p refs *Its* Geol. Surv. Profess. Paper 700-D
Avail: SOD $3.75

The scientific and economic results of geologic, hydrologic, and topographic studies are reported. Articles on the following subjects are included: structural geology, stratigraphy, paleontology, paleogeomorphology, geochronology, geochemistry, geophysics, economic geology, mineralogy and petrology, analytical methods, instruments and techniques, astrogeology, surface water, ground water, relation between ground water and surface water, geochemistry of water, salt water intrusion, waste disposal, and an evaluation of analog techniques for image registration. F.O.S.

N71-26645# Geological Survey, Denver, Colo.
APOLLO 7 PHOTOGRAPHY IN ANTOFAGASTA PROVINCE, CHILE: AN INTERPRETATION
Kenneth Segerstrom *In its* Geol. Surv. Res. 1970, Chapter D 1970 p D10-D17 refs (See N71-26644 14-13)
Avail: SOD $3.75

As a result of 1969 field checking of Apollo 7 (October 1968) color photography of northern Chile, photographic tonal values were correlated with the natural colors of surficial deposits and rock of the Salar de Atacama area. An east-west linear feature on Apollo 7 photographs of the Taltal-Salar de Gorbea area defies field identification because it is largely concealed by sedimentary and volcanic deposits. This feature is interpreted as a transverse fracture which has been inactive since Jurassic time. Fragmental evidence from Peru and central Chile indicates that despite its poor visibility on the ground and on conventional aerial photographs, an ancient structural trend transverse to the modern circum-Pacific trend is real, and its distribution is broader than has hitherto been recognized. Author

N71-26646# Geological Survey, Washington, D.C.
GAS CHROMATOGRAPHIC DETERMINATION OF CARBONATE CARBON IN ROCKS AND MINERALS
John Marinenko and Irving May *In its* Geol. Surv. Res. 1970, Chapter D 1970 p D103-D105 refs (See N71-26644 14-13)
Avail: SOD $3.75

A simple, rapid, and direct gas chromatographic method

for determining carbonate carbon in rocks and minerals was developed. Powdered samples are heated with phosphoric acid, and evolved gases are separated on a silica-gel column. Carbon dioxide is detected by thermal conductivity using helium as a carrier gas. The method is most applicable for determining carbon dioxide when only a limited quantity of sample is available. As little as two micrograms of carbon dioxide can be determined. Author

N71-26647# Geological Survey, Washington, D.C.
CHANGING PATTERNS OF THERMAL EMISSION FROM SURTSEY, ICELAND, BETWEEN 1966 AND 1969
Jules D. Friedman and Richard S. Williams, Jr. (AFCRL, Bedford, Mass.) *In its* Geol. Surv. Res. 1970, Chapter D 1970 p D116-D124 refs Sponsored in part by AFCRL, Bedford, Mass. and Iceland Natl. Energy Authority (See N71-26644 14-13)
Avail: SOD $3.75

A comparison is presented of the August 1968 aerial infrared images of Surtsey, Iceland, with 1966 aerial infrared survey data which indicates continued but generally diminishing thermal emission following cessation of effusive activity in mid-1967. Emission from most but not all secondary or rootless sources including flow fractures, collapse features, and secondary fumaroles diminished more rapidly than from primary convecting structures, notably ring fractures associated with the Surtur II vent, and linear structures related to faults which controlled various phases of eruptive activity between 1964 and 1967. However, thermal emission increased in 1969 from the Surtur I and II tephra rims. Heat flux from the tephra anomalies is estimated at greater than 1,500 microcal/sq cm/sec and is dominantly convective. Heat flux from the primary convecting structures may be an order of magnitude greater, suggesting a total heat transport to the surface of the island of 10 to the 9th power to 10 to the 10th power microcal/sec in 1969, less than 1 percent of the peak heat transport during the effusive eruption phase. Author

N71-26648# Geological Survey, Denver, Colo.
INDUCED POLARIZATION AND RESISTIVITY SURVEYS ON CLEARY SUMMIT, ALASKA
Lennart A. Anderson and Gordon R. Johnson *In its* Geol. Surv. Res. 1970, Chapter D 1970 p D125-D128 refs (See N71-26644 14-13)
Avail: SOD $3.75

Induced polarization and resistivity surveys are presented which were made on the north flank of Cleary Summit about 16 air miles north-northeast of Fairbanks, Alaska. Data were obtained along three traverses that were positioned to transect some of the known vein structures that have produced gold, silver, and other metallic minerals. Two disseminated sulfide concentrations of possible economic interest, one deep seated and the other about 75 to 150 feet beneath the surface, were detected. Author

N71-26649# Geological Survey, Denver, Colo.
GEOLOGIC INTERPRETATION OF A RESIDUAL AEROMAGNETIC MAP OF THE NIXON FORK DISTRICT, ALASKA
Lennart A. Anderson, Bruce L. Reed, and Gordon R. Johnson *In its* Geol. Surv. Res. 1970, Chapter D 1970 p D129-D133 refs (see N71-26644 14-13)
Avail: SOD $3.75

A residual aeromagnetic map covering approximately 480 square miles was compiled for the Nixon Fork district located about 35 miles northeast of McGrath, Alaska. The aeromagnetic survey was flown in search of concealed intrusive rocks similar to the quartz monzonite stocks that have produced contact metamorphic deposits in limestone, the principal source of gold in the district. Negative magnetic anomalies are associated with quartz monzonite stocks, establishing a useful criterion for locating favorable prospecting areas. Some new localities of possible economic interest in this area are discussed. Author

N71-26691# Indian National Scientific Documentation Centre, New Delhi.
ATMOSPHERIC AEROSOLS
E. S. Selezneva 1970 231 p refs Transl. into ENGLISH of the publ. 'Atmosfernye Aerozoli' Leningrad, Gidmeteorol. Izd., 1966 Sponsored in part by ESSA
(Contract NSF C-466)
(TT-68-50637) Copyright. Avail: Issuing Activity

The content, in the free atmosphere (up to an altitude of 6 km), of very minute aerosol particles (r < or = .0001 cm), usually called condensation nuclei was investigated. From the data of numerous aircraft observations made utilizing a Scholz counter, the characteristics of the concentration of condensation nuclei for different regions of the U.S.S.R. have been obtained. Laws for the vertical distribution of these nuclei have been determined, and the main features of their geographical variations ascertained. Author

N71-26796*# Geological Survey, Washington, D.C. Geographic Applications Program.
PRODUCTION OF A HIGH ALTITUDE LAND USE MAP AND DATA BASE FOR BOSTON Interim Report, Jun.-Dec. 1970
Robert B. Simpson (Dartmouth Coll.) Dec. 1970 46 p refs
(NASA Order W-13165; Contract D1-14-08-0001-12640)
(NASA-CR-118670; IR-4SGS-205) Avail: NTIS CSCL 08B

Data are presented on production of the map of the Boston area proper from CIR photography taken at 60,000 feet under the NASA Earth Resources Aircraft program in September 1969, and establishes an initial computer compatible data base. The Boston map and one for Washington, D.C., are designed to serve as prototypes for the proposed national 26-city program in urban change detection, which ultimately will utilize data from ERTS. In the creation of the Boston map reliance on the photo interpreter and photo laboratory has been emphasized. The data bank uses a basic map cell which is quite small (0.2 km on a side) and is UTM addressable. An initial experimental drawing of the Boston area urban-rural interface is provided. Author

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N71-25630# WADCO Corp., Richland, Wash.
HIGH TEMPERATURE MEASUREMENT INSTRUMENT FOR ADVANCED REACTORS
T. Roger Billeter and Donald P. Brown 26 Oct. 1970 15 p refs Presented at the Conf. on Power Reactor Systems and Components, Williamsburg, Va., 1-3 Sep. 1970
(Contract AT(45-1)-2170)
(WHAN-SA-24; CONF-700904-2; BNWL-SA-3180-S) Avail: NTIS

The theory and initial experiments for an accurate, rugged, and long-lived temperature sensor, primarily intended for application in severe environments are described. For in-core application in either high temperature, gas cooled or liquid-metal cooled reactors, sensor detection sensitivity remains nearly linear up to 1400 C for

a niobium-1% zirconium device. For abrupt temperature changes the experimental sensor yields time constants of 0.5 to 100 seconds, depending upon the thermal conductivity of the surrounding medium. Mechanical requirements as imposed by each specific reactor application also influence the attainable time response for abrupt temperature change. Of all-metal construction, the described experimental temperature sensor with its attached waveguide should permit direct immersion in the reactor coolant and should give long lived service. (NSA)

N71-25631# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
PLANT INSTRUMENTATION PROGRAM Quarterly Report, Jul.–Sep. 1970
D. M. Bishop and E. A. Aitken, comps. Oct. 1970 95 p refs
(Contract AT(30-1)-68)
(GEAP-12114-3; BHO-68-3; QR-2) Avail: NTIS

Technical efforts associated with the Plant Instrumentation Program were directed toward the evaluation and qualification of nuclear assay instrumentation in time for their application to upcoming fuel fabrication programs. The evaluation of assay instrument techniques on prepared fuel rod, scrap, and waste standards is in the final stages. Approximately 600 individual assay tests were performed with calorimeter, gamma (sodium iodide and germanium-lithium) and neutron (gross and coincident) instrumentation techniques. Plans were formulated for the application of selected instrumentation to fuel fabrication programs, including the nondestructive nuclear assay of input, process, and product output materials. Author (NSA)

N71-25636# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Dept. of Thermodynamics.
MANUAL FOR EQUIPMENT FOR MEASUREMENT OF COEFFICIENTS OF THERMAL CONDUCTIVITY AND HEAT CAPACITY KC 300
G. Hauser and R. Strittmatter 1 Mar. 1970 158 p
(Contract ESTEC-576/68)
Avail: NTIS

By means of this equipment, the absolute coefficients of thermal conductivity of solids can be determined within the limits from 0.002 to 0.2 W/cm C at temperatures ranging from −186 to +300 C. Furthermore, this equipment can be used, after conversion, for measuring the heat capacity of solids within the limits from 0.1 to 2 J/g x C at temperatures ranging from −186 to +300 C. Detailed operating instructions as well as documents for data evaluation are provided. Author (ESRO)

N71-25663*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DETERMINATION OF GAS TEMPERATURES FROM LASER RAMAN SCATTERING
Jack A. Salzman, William J. Masica, and Thom A. Coney Washington May 1971 35 p refs
(NASA-TN-D-6336; E-6019) Avail: NTIS CSCL 14B

An investigation was conducted on the feasibility of using Raman scattered laser light to measure local gas temperatures. Temperature error predictions were made based on the statistics of the scattering process and Raman spectral theory. Methods were developed for the calculation of temperature measurement accuracies as a function of Raman signal for different spectral line ratio schemes. The results of these theoretical calculations were compared with experimental rotational Raman data obtained from a laboratory constructed Raman spectro-photometer. Nitrogen was used as a gas sample for a range of controlled temperatures from 253 to 313 K and pressures from 0.5 to 5.0 atmospheres. Author

N71-25664# National Science Foundation, Washington, D.C.
REGULATION OF BINDING PRESSURES IN DIFFUSION COUPLES
A. V. Antonovich 1970 7 p Transl. into ENGLISH from Zavodsk. Lab. (Moscow), v. 21, 1955 p 991–992 Prepared in part by NBS
(TT-70-59121; DMDC-5900) Avail: NTIS CSCL 11F

While carrying out a diffusion experiment with long times, automatic recordings were used for the deformation measurement process. The recording is carried out by registering galvanometer provided with an induction transmitter. The induction transmitter is set in a bridge circuit of alternating current. The change in linear sizes of the sample is carried out by self-recording galvanometer. One of the positions of the galvanometer is connected with a ring of cuperic oxide elements and the other is fixed to the temperature regime of the furnace. By decreasing the clearance between armature and the core of one of the coils, the induction of this coil is increased and the voltage in cupperic oxide ring diagram changes in proportion to the change of clearance magnitude between armature and the core. Author (GRA)

N71-25748*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DEVELOPMENT OF AN AIR FLOW THERMAL BALANCE CALORIMETER
Joseph M. Sherfey May 1971 41 p refs
(NASA-TM-X-65546; X-764-71-190) Avail: NTIS CSCL 14B

A new air flow calorimeter, based on the idea of balancing an unknown rate of heat evolution with a known rate of heat evolution, is described. Under restricted conditions, the prototype system is capable of measuring thermal wattages from ten milliwatts to one watt, with an error no greater than one percent. Data are presented which reveal system weaknesses and point to modifications which would effect significant improvements. Author

N71-25837*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOUNDING ROCKET INSTRUMENTATION DATA AEROBEE 350, FLIGHT 17.05GT-GG
B. Robert Pincus, Joseph S. Stephenson, and Thomas E. Thompson, Jr. Apr. 1971 182 p
(NASA-TM-X-65539; X-743-71-159) Avail: NTIS CSCL 14B

A compilation of information on instrumentation of the Aerobee 350 rocket Flight 17.05GT-GG is presented. Data were obtained from calibration checks and tests that were made in preparation for the flight, on instrumentation components. Tolerances and accuracies of the rocket instrumentation components, a record of instrumentation systems used, the orientation of the installation of the systems, and necessary information to be used in the data reduction of post-flight records are included. Author

N71-25838# Joint Publications Research Service, Washington, D.C.
ACTINOMETRIC INSTRUMENTS ABOARD SOVIET METEOROLOGICAL SATELLITES
V. A. Beskin et al 14 May 1971 12 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ. (Moscow), no. 100, 1970 p 125–135
(JPRS-53137) Avail: NTIS

The equipment on Soviet meteorological satellites is described which consists of two types of actinometric instruments. The first type is a narrow angle scanning instrument (lucimeter) with an instantaneous field of view of 4 × 5 deg with an operating viewing angle of + or − 66 deg from the vertical to the plane perpendicular to the flight trajectory of the satellite. The second type is a wide angle instrument (a flux density meter) with a viewing angle of 136 to 140 deg. The instruments are duplicated in order to improve the operating reliability. The energy brightnesses of the narrow

angle instrument are measured in three spectral ranges (0.3 to 3, 8 to 12 and 3 to 30 microns) over two independent channels; the 8 to 12 and 3 to 30 micron ranges are combined in one measuring channel and are selected by changing the corresponding optical filters. In the 0.3 to 3 micron channel, the instrument operates as a single-beam system, and in the 3 to 30 and 8 to 12 micron channel, as a dual-beam system. The earth-space modulation method is used in the last channel, in which the measurable radiation is compared with the radiation of outer space. The density of the radiant flux from the earth into outer space is measured by the wide-angle nonscanning instrument in two spectral ranges; 0.3 to 3 and 3 to 30 microns. Author

N71-25892* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

METHOD OF TEMPERATURE COMPENSATING SEMICONDUCTOR STRAIN GAGES Patent

Chris Gross, inventor (to NASA) Issued 23 Sep. 1969 5 p Filed 15 Nov. 1966 Cl. 148-13; Int. Cl. C22f3/00
(NASA-Case-XLA-04555-1; US-Patent-3,468,727; US-Patent-Appl-SN-594584) Avail: US Patent Office CSCL 14B

Radiation damage studies have provided a method of significantly reducing the sensitivity of the semiconductor gage to changes in temperature. The method consists of exposing commercially available semiconductor gages of a specific resistivity to a prescribed dose of high energy damaging radiation. After irradiation, the change in gage resistance and gage factor with temperature is reduced by a factor of over twenty-five of the unirradiated gage over a 50 C. temperature interval. Official Gazette of the U.S. Patent Office

N71-25893# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

FRICTION COEFFICIENTS OF MATERIALS USED IN CINEMA EQUIPMENT

I. S. Golod et al 30 Nov. 1970 14 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (Moscow), v. 13, no. 10, 1969 p 15–18
(AD-720376; FTD-HT-23-718-70) Avail: NTIS CSCL 14/5

The coefficients of frictions of pairs of materials used in cinema apparatus were determined. The gliding coefficients were determined for the range found in practice, and the rest coefficients for the emulsion layer of the cine film in contact with various materials. Author (GRA)

N71-25901* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

METHOD FOR IMPROVING THE SIGNAL-TO-NOISE RATIO OF THE WHEATSTONE BRIDGE TYPE BOLOMETER Patent

Antony Jalink, Jr., inventor (to NASA) Issued 9 Mar. 1971 3 p Filed 1 Oct. 1968 Cl. 250-83.3; Cl. 250-43.5; Cl. 340-233; Cl. 340-285; Int. Cl. G01j5/24
(NASA-Case-XLA-02810; US-Patent-3,569,710; US-Patent-Appl-SN-764252) Avail: US Patent Office CSCL 14B

An improvement in the signal-to-noise ratio of a Wheatstone bridge type radiation measuring instrument is discussed. The improvement consists of replacing the shielded element in the bridge by an identical element except that it is K times as large and had K times as much resistance and replacing the voltage source adjacent to the replaced element by a power source producing K times as many volts where K is greater than one. Official Gazette of the U.S. Patent Office

N71-25926*# Atomics International, Canoga Park, Calif.

ALUMINUM BONDED LEAD TELLURIDE THERMOELECTRIC MODULE STUDY FOR NON-MAGNETIC AND VACUUM APPLICATIONS Final Report, 5 Mar. 1968–5 Feb. 1970

1 Mar. 1971 26 p refs
(Contract NAS5-11514)
(NASA-CR-118637; AI-70-22) Avail: NTIS CSCL 14B

The principal items of recent progress are: (1) a demonstration that a tungsten barrier between the P hot junction and the aluminum hot strap greatly retards degradation; and (2) corroborative evidence that close-fitting of the thermal insulation inhibits serious sublimation of PbTe at higher operating temperatures. Author

N71-25971# Joint Publications Research Service, Washington, D.C.

PROTON MAGNETOMETER FOR GEOMAGNETIC SURVEY IN THE OCEAN

N. N. Karnaushenko et al *In its* Marine Hydrophys. Res. 29 Apr. 1970 p 43–49 refs (See N71-25966 14-13)
Avail: NTIS

A towed proton magnetometer developed in the Department of Electromagnetic Phenomena in Seas and Oceans of the Marine Hydrophysical Institute is described. Results of a magnetic survey in the Black Sea are also given. Author

N71-26008# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

ELECTRON PARAMAGNETIC RESONANCE SPECTROMETERS OPERATING UNDER IRRADIATION [SPECTROMETRES DE RESONANCE PARAMAGNETIQUE ELECTRONIQUE SOUS RAYONNEMENTS]

Christian Santier (Ph.D. Thesis – Grenoble Univ.) Dec. 1970 149 p refs In FRENCH
(CEA-R-4022) Avail: AEC Depository Libraries

Two laboratory constructed paramagnetic resonance spectrometers for in-situ studies of radiation induced defects are described. One of these instruments is associated with the core of a nuclear reactor, operating in a mixed flux of neutrons and gamma rays. The other is used in conjunction with a gamma radiation source. Some experimental results obtained with these instruments are discussed. Author (NSA)

N71-26026*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

A FINE SUN SENSOR FOR SKYLAB'S APOLLO TELESCOPE MOUNT

J. D. Johnston 31 Mar. 1971 50 p
(NASA-TM-X-64599) Avail: NTIS CSCL 14B

The three black boxes that make up the fine sun sensor assembly for the Apollo Telescope Mount are described. The performance characteristics, testing, and qualification results are also included. The design, evaluation, laboratory, and solar test results offer strong corroborative proof that such a system will give the Skylab a pointing capability of + or – 24 arc min in both pitch and yaw axes, accurate to 2 arc sec or less. Author

N71-26108# Oklahoma Univ., Norman. School of Electrical Engineering.

THE APPLICATION OF A CONFOCAL INTERFEROMETER TO VELOCITY MEASUREMENTS

William L. Kuriger [1971] 15 p refs Presented at the 1971 IEEE/OSA Conf. on Laser Engr. and Appl., Washington, D.C., 2–4 Jun. 1971 Submitted for publication
Avail: NTIS

A laser Doppler velocity measuring device employing a scanning interferometer was constructed and utilized. The unit was found to be very simple to operate, and the freedom from any stringent alignment requirements permits considerable flexibility in the system design. Author

N71-26135* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THERMALLY CYCLED MAGNETOMETER Patent
Grant W. Coon, inventor (to NASA) Issued 16 Feb. 1971 9 p Filed 16 Aug. 1965 Cl. 324-43; Int. Cl. G01r33/02
(NASA-Case-XAC-03740; US-Patent-3,564,401; US-Patent-Appl-SN-480211) Avail: US Patent Office CSCL 14B

A magnetometer for measuring static and dynamic magnetic fields is reported. A sensing coil surrounds a magnetic core. The temperature of the core is thermally cycled above and below the Curie temperature of the core thereby causing the permeability of the core to fluctuate. A voltage proportional to the magnetic field under test is induced in the sensing coil.
Official Gazette of the U.S. Patent Office

N71-26136* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LIGHT SHIELD AND INFRARED REFLECTOR FOR FATIGUE TESTING Patent
Walter Illg and Fred F. Eichenbrenner, inventor (to NASA) Issued 14 Oct. 1969 6 p Filed 31 Aug. 1966 Cl. 73-15.6; Int. Cl. G01n25/02
(NASA-Case-XLA-01782; US-Patent-3,472,060; US-Patent-Appl-SN-576792) Avail: US Patent Office CSCL 14B

An apparatus for fatigue testing of small axially loaded sheet specimens at elevated temperatures in the range of 2000–3000 F and in an ambient atmosphere is described. The choice is suitable for conditions which do not allow mechanical probing of the test area with thermocouples or other contact instruments. It uses a watercooled quartz lamp radiation source, optical pyrometer means for detecting temperature change in a specimen during a test, and shielding for protecting the optical pyrometer from the radiation source.
Official Gazette of the U.S. Patent Office

N71-26137* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DUAL RESONANT CAVITY ABSORPTION CELL Patent
Major C. Lee and William F. White, inventors (to NASA) Issued 9 Feb. 1971 4 p Filed 27 Mar. 1969 Cl. 324-0.5; Cl. 324-58.5
(NASA-Case-LAR-10305; US-Patent-3,562,631; US-Patent-Appl-SN-811037) Avail: US Patent Office CSCL 14B

An absorption cell for holding a gas sample to be analyzed by microwave double resonance spectroscopy is described. A pair of Fabry-Perot interferometers are arranged in the cell so that their microwave fields propagate at right angles. One interferometer acts as a resonant cavity at the pumping frequency and the second as a resonant cavity at the observing frequency. Double resonance transitions occur in the volume common to both microwave fields.
Official Gazette of the U.S. Patent Office

N71-26161* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RESILIENCE TESTING DEVICE Patent
Daniel H. Weitzel and Jerry C. Jellison, inventors (to NASA) Issued 27 Apr. 1971 5 p Filed 20 Oct. 1969 Cl. 73-79; Cl 73-12; Int. Cl. G01n3/52
(NASA-Case-XLA-8254; US-Patent-3,576,127; US-Patent-Appl-SN-867843) Avail: US Patent Office CSCL 14B

An automated ball rebound resilience testing system is described. It is used to measure the resilient behavior of materials at varying temperatures. The apparatus consists of a light source with the beam focused on a photocell. When the light beam is interrupted as objects are dropped through it and rebounded, signals are emitted from the photocell and pass through a pulse amplifier, a counter timer and lastly are recorded on a printer, thus providing data for determining the resilience of the sample.
Official Gazette of the U.S. Patent Office

N71-26191# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
AERIAL RADIOLOGICAL DETECTION EQUIPMENT (AIR) Final Report
15 Jan. 1971 28 p refs
(AD-720567; MTP-6-3-335) Avail: NTIS CSCL 18/8

Procedures are described for conducting aerial radiological surveys to evaluate radiological detection equipment. Flight adaptability, human factors, and operational considerations are discussed.
Author (GRA)

N71-26199* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FLUID PHASE ANALYZER Patent
Lance G. Hays, inventor (to NASA) Issued 2 Mar. 1971 6 p Filed 17 Apr. 1969 Cl. 73-61; Int. Cl. G01n25/00 Sponsored by NASA
(NASA-Case-NPO-10691; US-Patent-3,566,676; US-Patent-Appl-SN-816988) Avail: US Patent Office CSCL 14B

An analyzer is described for determining the relative amount of liquid and vapor in a mixed phase body of fluid. A hollow closed-end gage containing a heat transport fluid and having its walls lined with capillary wick is partially inserted into contact with both phases of the body. Heat is exchanged with the body and heat is transferred from the portion immersed in the body to an external portion of the gage. In one embodiment a thermocouple attached of the external portion measures a parameter related to the heat transferred and therefore the phase distribution. In another embodiment, the thermocouple is utilized to maintain the wall temperature at a fixed temperature and energy input to a heater associated with the external portion to provide the desired parameter.
Official Gazette of the U.S. Patent Office

N71-26207# Centre d'Etude de l'Energie Nucleaire, Brussels (Belgium).
THE FABRICATION OF Ge(Li) DETECTORS
P. Fettweis Sep. 1970 27 p refs
(BLG-447) Avail: AEC Depository Libraries

The fabrication of lithium-drifted germanium detectors for use in gamma-ray spectroscopy is described. The performances of the different types such as planar and one and two open-ended coaxial detectors are briefly discussed in view of their applications in straight spectroscopy and timing circuits.
Author (NSA)

N71-26217"# Arizona Univ., Tucson.
CALIBRATION OF LOW H2O METER
D. P. Cruikshank and A. B. Thomson *In its* Commun. of the Lunar and Planetary Lab., Commun. Nos. 153–159, Vol. 8, Pt. 5 1970 p 397–398 refs *Its* Commun. No. 159 (See N71-26209 14-30)
Avail: NTIS CSCL 14B

An independent calibration is presented of the Low hygrometer, used extensively at this Laboratory during the past five years. For water-vapor amounts smaller than 3 mm, Dr. Low's calibration is confirmed. For larger amounts, a small systematic difference appears to exist which needs further investigation. Adequate allowance for the atmospheric pressure must be made in the interpretation of the measures.
Author

N71-26244* Lockheed Electronics Co., Houston, Tex.
AUTOMATIC SIGNAL RANGE SELECTOR FOR METERING DEVICES Patent
Charles T. McCormick, Jr., Robert A. Doughty, and Ernest L. Camp, inventors (to NASA) Issued 26 Aug. 1969 4 p Filed 17 Feb. 1967 Cl. 324-115; Int. Cl. G01r1/38, 15/08 Sponsored by NASA
(NASA-Case-XMS-06497; US-Patent-3,464,012; US-Patent-Appl-SN-617778) Avail: US Patent Office CSCL 14B

A voltage range selection apparatus is described for automatically sensing and applying voltages to electronic instruments without loading the signal source. Signal voltages are sensed by

a plurality of voltage sensing and triggering circuits each consisting of a voltage sensing unit and a modified Schmitt trigger which operates with low hysteresis within one percent of the trigger level for operating an associated switching relay. When energized, the associated relay applies the input signal voltage to one of a plurality of meter ranging resistors and selectively applies power to one of a plurality of range indicating lamps.
Official Gazette of the U.S. Patent Office

N71-26260# Research Inst. of National Defence, Stockholm (Sweden).
METER FOR MEASURING FLUID ANGULAR VELOCITY IN A VORTED FLOW, THE VORTEX GYRO (LITERATURE STUDY) [FLUIDA VINKELHASTIGHETSGIVARE MED VORTEXSTROEMNING VORTEXGYRON]
J. Sundelin Nov. 1969 49 p refs In SWEDISH
(FOA-2-C-2358-54) Avail: NTIS CSCL 14B

The principles of fluid vortex gyros for measuring angular velocities in vortex flows are described. Experimental profiles of velocity components and radial pressure distributions in short cylindrical vortex containers are compared to theoretical fluidics calculations. G.G.

N71-26266* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VARIABLE FREQUENCY NUCLEAR MAGNETIC RESONANCE SPECTROMETER Patent
Dimiter I. Tchernev, Harry G. Vorkink, and John E. Guisinger, inventors (to NASA) Issued 21 Oct. 1969 6 p Filed 18 Apr. 1967 Cl. 324-0.5; Int. Cl. G01n27/00; 23/00; Int. Cl. G01r33/08 Sponsored by NASA
(NASA-Case-XNP-09830; US-Patent-3,474,328; US-Patent-Appl-SN-632165) Avail: US Patent Office CSCL 14B

A nuclear magnetic resonance spectrometer with a variable frequency master drive source providing drive signals over a relatively wide frequency range is considered. A slave oscillator is frequency locked to the master drive source to provide a frequency output which is a fixed frequency difference above the drive varying frequency. The outputs of the drive source and the slave oscillator are heterodyned in a first loop to provide the frequency difference which is amplified in a high gain amplification arrangement tuned to the frequency difference rather than to the varying frequency of the drive source. The frequency differences produced in the two heterodyning loops are phase detected to minimize noise effects.
Official Gazette of the U.S. Patent Office

N71-26270 Houston Univ., Tex.
THE DEVELOPMENT AND CHARACTERIZATION OF A SUPERCRITICAL STATE CHROMATOGRAPHIC SYSTEM WITH A NEW MICRO ADSORPTION DETECTOR
Jesse Lee Cashaw (Ph.D. Thesis) 1970 81 p
Avail: Univ. Microfilms Order No. 70-12472

The use of fluids above their critical temperatures and pressures in chromatography is investigated. Supercritical fluid chromatography (SFC) combines some of the advantages of both gas and liquid chromatography. High molecular weight compounds can be separated rapidly by utilizing SFC. A complete system for SFC is described. The system employs a metering pump, relief valve, damping device, constant pressure regulator, sample injection valve, oven, flow controller, and a heat of adsorption detector. The detector is composed of multi-thermocouples (thermopile) with a suitable adsorbent embedded in one end which becomes the hot junction, and the opposite end serves as the cold junction. The temperature changes resulting from the heats of adsorption and desorption of compounds eluted from the column are measured. The detector is unique in that by the proper selection of the mobile phase and the adsorbent, all substances separated can be detected making it of universal application. Dissert. Abstr.

N71-26363*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SIXTH TRANSDUCER WORKSHOP
White Sands Missile Range, N.Mex. Range Commanders Council 1969 182 p refs 22–24 Oct. 1969
(NASA-TM-X-67179; AD-712467; Doc-112-70) Avail: NTIS CSCL 09A

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2. MEASUREMENT OF PRESSURE AND FLOW p 19–63 refs (See N71-26365 14-14)
3. GENERAL MEASUREMENT PROBLEM AREAS p 65–119 refs (See N71-26366 05-14)
4. MEASUREMENT OF FORCE AND ACCELERATION p 121–174 refs (See N71-26367 14-14)

N71-26365*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MEASUREMENT OF PRESSURE AND FLOW
In its Sixth Transducer Workshop 1969 p 19–63 refs (See N71-26363 14-14)
Avail: NTIS CSCL 14B

Two types of internal rocket-motor probes used in a JPL resonant combustion program are described. The Greyrad probes can be adjusted within their adapters to measure high-frequency pressure variations at locations 1/2 in. to 5-1/2 in. from the inside of the chamber wall. Thermal protection is provided by high water-flow rates through inner and outer tube bundles. Approximately two-thirds of the water is used to cool the outer tube bundle and exits above the 90-deg bend in the probe. Information on testing and evaluation of the probes, actual pressure data obtained during instability firings, and conclusions drawn from this information are presented. Author

N71-26367*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MEASUREMENT OF FORCE AND ACCELERATION
In its Sixth Transducer Workshop 1969 p 121–174 refs (See N71-26363 14-14) Avail: NTIS CSCL 14B

The wide band acceleration instrumentation for the Rover ground test facility dual liquid hydrogen turbopump system are described. Structural and flow induced vibrations are studied. Transducer environments varied from 530 to 114 degree Rankine with complex acceleration levels up to 2,000 g's pk-pk. Elementary analyses in support of transducer selection and transducer mounting considerations are presented. The need for knowing the total transducer and mounting environment is emphasized. Author

N71-26461# Joint Publications Research Service, Washington, D.C.
STUDY OF THE SUBJECTIVE ESTIMATION OF IMAGE QUALITY (ALL UNION SYMPOSIUM IN MOSCOW)
S. M. Kozlovskiy *In its* Vestn. of the USSR Acad. of Sci., Vol. 40, No. 6, 1970 31 Aug. 1970 p 146–148 refs (See N71-26452 14-30)
Avail: NTIS

Approaches to the evaluation and improvement of image quality are outlined. Considered are mathematical models able to describe both objective and subjective parameters of quality, statistical formulations, methods of subjective psychophysics, correlation methods for objective and subjective measurements, and cybernetic methods to process experimental data on the subjective evaluation of complex reproductions having different values in a fixed set characterizing their signs. G.G.

N71-26474* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

IMAGE MAGNIFICATION ADAPTER FOR CAMERAS Patent
Fred L. Moffitt, inventor (to NASA) Issued 14 Oct. 1969 5 p Filed 12 Dec. 1966 Cl. 95-44; Int. Cl. G03b3/00
(NASA-Case-XMF-03844-1; US-Patent-3,472,140; US-Patent-Appl-SN-601229) Avail: US Patent Office CSCL 14E

An adapter unit for attachment to a camera, such as a Polaroid type, is described which permits the camera to produce magnified photographic views of subject matter. The adapter carries its own magnifying lens as well as its own illumination source and may be attached to or removed from a camera without any camera modification being required. In operation, the front end of the adapter is ordinarily positioned in contact with or very near the subject matter being photographed and the illumination passes from a lighting compartment within the adapter to the subject matter, with no external lighting source being required.
Official Gazette of the U.S. Patent Office

N71-26475* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CONICALLY SHAPED CAVITY RADIOMETER WITH A DUAL PURPOSE CONE WINDING Patent
James M. Kendall, Sr. and Joseph A. Plamondon, Jr., inventors (to NASA) Issued 12 Aug. 1969 8 p Filed 3 Oct. 1966 Cl. 250-83.3; Int. Cl. G01t1/16; Int. Cl. H01j39/00 Sponsored by NASA
(NASA-Case-XNP-09701; US-Patent-3,461,290; US-Patent-Appl-SN-584015) Avail: US Patent Office CSCL 14B

A black body radiation receptor in the form of a conically shaped cavity is described with cone winding, which is in thermal contact with the cone, serving both as a temperature sensor and cavity heating element. The receptor is surrounded by a thermal guard, having a guard temperature sensing element, which together with the cone winding is connected in a dc bridge configuration to provide a control signal for control of the power supply to the cone winding in order to maintain the cavity in temperature equilibrium with the thermal guard. The power supplied to the cone winding to maintain temperature equilibrium is a function of the radiation into the receptor, the equilibrium temperature, and the cone's area.
Official Gazette of the U.S. Patent Office

N71-26478# National Bureau of Standards, Washington, D.C.
ULTRASONIC AND DILATOMETRIC MEASUREMENTS AT VERY HIGH PRESSURES
Peter L. M. Heydemann and James C. Houck *In its* Accurate Characterization of the High Pressure Environment Mar. 1971 p 11-23 refs (See N71-26476 14-12)
Avail: SOD $4.50

A short cylinder and piston assembly and its use for dilatometric and ultrasonic measurements on solids and liquids at pressures up to 40 kbar are described. All necessary corrections for the evaluation of measurements are discussed and the systematic uncertainties are given. It is demonstrated that ultrasonic methods can significantly reduce the uncertainties in the determination of density and bulk modulus of both solids and liquids. Author

N71-26483# All-Union Research Inst. for Physical and Radiotechnical Measurements, Mendeleevo (USSR).
MANGANIN RESISTANCE GAGES AS ACCURATE INSTRUMENTS FOR HIGH PRESSURE MEASUREMENTS
Yu. A. Atanov and E. M. Ivanova *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 49-51 ref (See N71-26476 14-12)
Avail: SOD $4.50

Investigated are the scatter of metrological characteristics of a large group of identical manganin gages by means of an absolute free piston gage, to find the best extrapolation equation and to evaluate possible errors of pressure measurements over 15 kbar. Author

N71-26484# General Electric Co., Schenectady, N.Y. Research and Development Center.
A CRITICAL REVIEW OF THE EFFECT OF PRESSURE ON EMF's
R. E. Hanneman, H. M. Strong, and F. P. Bundy *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 53-62 refs (See N71-26476 14-12)
Avail: SOD $4.50

The effects of high pressure on the emf's of thermocouples are critically reviewed and best currently available thermocouple corrections are presented. The important factors affecting these thermocouple corrections are discussed, including pressure-temperature gradients, contamination, and deformation. A novel method for simultaneous and continuous in situ measurements of pressure and temperature within a high pressure cell through use of dual thermocouples is briefly described. Author

N71-26485# Carnegie Institution of Washington, D.C. Geophysical Lab.
THE EFFECT OF PRESSURE ON THE THERMAL emf OF THE PLATINUM/PLATINUM 10 PERCENT RHODIUM THERMOCOUPLE
P. M. Bell, F. R. Boyd, Jr., and J. L. England *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 63-65 refs (See N71-26476 14-12)
Avail: SOD $4.50

Pressure decreases the thermal emf of a platinum/platinum 10 percent rhodium thermocouple, requiring a positive correction to the reading for some pressure above atmospheric. This effect is not linear with pressure or temperature, but its magnitude increases with both pressure and temperature. Author

N71-26486# Battelle Memorial Inst., Columbus, Ohio.
PRESSURE DEPENDENCE OF THE THERMOELECTRIC POWER OF THERMOCOUPLE MATERIALS
Paul J. Freud and Phillip N. La Mori *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 67-75 refs (See N71-26476 14-12)
Avail: SOD $4.50

Single wire measurements of the pressure dependence of the thermoelectric power were made hydrostatically to 8 kbar for chromel, alumel, copper, and constantan and in a piston cylinder apparatus to 40 kbar for chromel, alumel, platinum, and platinum-10 percent rhodium. The temperature interval covered for the hydrostatic measurements was 195 C to 290 C and for the piston cylinder measurements it was 30 C to 380 C. A detailed discussion is given of the pressure-temperature distribution within the piston cylinder cell. Pressure emf values are presented with an uncertainity of + or - 7 percent. Author

N71-26487# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
THE EFFECT OF PRESSURE ON THE emf OF THERMOCOUPLES
Ivan C. Getting and George C. Kennedy *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 77-80 (See N71-26476 14-12)
Avail: SOD $4.50

High pressure and temperature effects on electromotive forces generated by a thermocouple of compressed and uncompressed segments of the same wire in a piston-cylinder apparatus are reported. Intercomperison of readings for platinum-10 rhodium thermocouples with Chromel-Alumel thermocouples agreed with indicated corrections of algebraic differences created by thermocouple junctions between compressed and uncompressed segments. G.G.

N71-26511# All-Union Research Inst. for Physical and Radiotechnical Measurements, Mendeleevo (USSR).

ON APPLICATION OF MERCURY MELTING CURVE FOR ACCURATE HIGH PRESSURE MEASUREMENTS

V. S. Bogdanov, Yu. L. Levin, S. S. Sekoyan, and Yu. I. Shmin *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 297 - 302 refs (See N71-26476 14-12)
Avail: SOD $4.50

On the basis of the experimental data up to 15 kbar the mercury melting curve equation is obtained. This equation is recommended for pressure measurements in the range from 7 to 40 kbar. The errors of the extrapolated equation are estimated not to exceed 1 percent up to 40 kbar. Author

N71-26518# Kernforschungszentrum, Karlsruhe (West Germany). Labor fuer Elektronik und Messtechnik.

FUNDAMENTAL PRINCIPLES ON DIMENSIONING OF A COUNTER-TIMER SYSTEM [GRUNDLEGENDE UEBERLEGUNGEN ZUR DIMENSIONIERUNG EINES ZAEHLER-TIMER-SYSTEMS]

K. Tradowsky Oct. 1970 10 p In GERMAN; ENGLISH summary
(NP-18655) Avail: AEC Depository Libraries

The counting of statistical events is described to establish requirements for specifications for a scaler-timer system. The calculation shows the requirements for such a system depending on dead time and pulse repetition rate at a given accuracy. Author (NSA)

N71-26569# Commissariat a l'Energie Atomique, Paris (France).

NORMALIZATION OF TEST FOR DETECTORS MEASURING EXTERNAL IRRADIATION. 1: DETECTORS FOR MEASURING EXTERNAL IRRADIATION BY MEANS OF ELECTROMAGNETIC RADIATIONS

Dec. 1970 115 p refs In FRENCH
(CEA-R-4009(1)) Avail: AEC Depository Libraries

The normalized procedures used in the C.E.A. for standardizing and determining the spectral sensitivities of detectors for measuring external irradiation by electromagnetic radiation are described. Standardization involves the reference detector and the reference radioactive source. The following factors concern spectral sensitivity measurements: reference detector; the reference radioactive sources used; and the use of x ray generators (fluorescence or filtration). The technical details of the reference detector and those of a widely used detector (Babyline) are given. Author (NSA)

N71-26591# Jyvaskyla Univ. (Finland). Dept. of Physics.

SEMICONDUCTOR DETECTOR TELESCOPE ELECTRON SPECTROMETER

J. Kantele and A. Passoja Oct. 1970 16 p refs
(NP-18617) Avail: AEC Depository Libraries

A simple dE/dx + E type semiconductor detector telescope electron spectrometer featuring high detection efficiency and effective discrimination against gamma-rays and heavy particles is described. The line shape of the spectrometer is better than that of a single detector of corresponding size; at 1 MeV, the peak-to-total ratio is approximately 0.8. The device is suited to the study of beta-ray spectra and conversion electron lines at energies above about 0.4 MeV. Author (NSA)

N71-26592# Jyvaskyla Univ. (Finland). Dept. of Physics.

DESIGN, CONSTRUCTION, AND CHARACTERISTICS OF SOME Ge(Li) DETECTORS AND SPECTROMETERS

Pekka Suominen (Ph.D. Thesis) Aug. 1970 115 p refs
(NP-18653) Avail: AEC Depository Libraries

Experience obtained in preparing different kinds of Ge(Li) detectors is presented. The preparation method used involves an unusual sodium hypochlorite etching procedure. A method for externally cooling the field effect transistor of a standard preamplifier is presented and some test results are described. A semitoroidal detector configuration intended for making large Ge(Li) detectors with approximately homogeneous electric fields is described. Test measurements were carried out with a relatively small semitoroidal detector. Some data obtained with an anti-Compton spectrometer, which results in a peak-to-tail ratio of 200 for Cs-137 spectrum, are presented. Cryogenic and electronic problems concerning the performance of the anti-Compton spectrometer are discussed. Some two-crystal pair spectrometers were tested and possibilities for further development are discussed. Author (NSA)

N71-26604# European Atomic Energy Community, Karlsruhe (West Germany). European Inst. for Transuranium Elements.

DEVELOPMENT OF A SCINTILLATION DETECTOR FOR FAST ION COUNTING IN A MASS SPECTROMETER

H. A. Tasman 1970 30 p refs
(EUR-4567) Avail: AEC Depository Libraries

A description is given of a scintillation detector, designed for fast counting of 3 keV heavy ions. It applies intermediate acceleration to the incident ions to permit reliable operation with 60 kV conversion voltage. The pulse-height spectrum measured at the detector output allows the estimation of the counting efficiency as well over 95% with a background of only 3 counts per second. An experimental correction formula for counting losses, based on a dead time of 25.2 nano/seconds, together with additional corrections at very high as well as at very low counting rates, seems to hold up to about 5 MHz. However, in spite of apparently correct performance, isotope ratios measured show a scatter of + or − 1%, which is two to three times the scatter from a standard open-multiplier detector. The origin of the scatter could not be traced. In the present state, the scintillation detector should not be preferred for measurement of ion beams of more than 10 to the 15th power A since the standard multiplier offers a better reproducibility at lower complexity and cost. Author (NSA)

N71-26607*# Perkin-Elmer Corp., Pomona, Calif. Aerospace Div.

COMBINED STUDY PROGRAM. VOLUME 6: UNDERSEA ATMOSPHERIC ANALYZER Final Report

Burd. F. Bicksler Mar. 1971 136 p
(Contract NAS1-9469)
(NASA-CR-11890; SPO-30006-Vol-6) Avail: NTIS CSCL 14B

A program was conducted in which an instrument system concept was studied to optimize the application of a mass spectrometer as a sensor for monitoring the primary atmospheric constituents, as well as atmospheric contaminants, on board a manned spacecraft. As part of the program, an undersea atmospheric sensor system was designed to monitor and display the atmospheric constituents of nitrogen, oxygen, carbon dioxide, water vapor, and argon during at-sea operational deployment of a test vehicle. Data recorded during 5-day sea trial and during a subsequent 62-day sea deployment indicates unusually stable long term operation. In addition, data recorded by crew members of the U.S.S. Hammerhead is presented which compares the sensor system with other analyzer systems including the Mark 5 and a portable oxygen analyzer. Author

N71-26624 Texas A&M Univ. College Station.

THE DEVELOPMENT AND EVALUATION OF AN INSTRUMENTATION SYSTEM FOR USE IN SCATTERED LIGHT PHOTOELASTICITY

Edmond Ira Bailey (Ph.D. Thesis) 1969 53 p
Avail: Univ. Microfilms Order No. 70-11528

A program was conducted to develop an instrumentation system to be used for obtaining accurate measurements of the interference fringe spacing in scattered light photoelasticity. To circumvent difficulties encountered in modulating the light source, a stable dc intensity measuring system was developed along with the necessary optics. In support of this effort, a comprehensive study of materials to be used in scattered light photoelasticity was carried out. Other support efforts are described and results of a

brief test of a sphere in diametral compression are given.
Dissert. Abstr.

N71-26627* Sperry Rand Corp., Huntsville, Ala. Space Support Div.
OPTICAL TRACKING MOUNT Patent
Roy Broussard and Josef M. Beehm, inventors (to NASA) Issued 2 Feb. 1971 6 p Filed 26 Feb. 1968 Cl. 248-183; Cl. 308-9; Int. Cl. F16c17/16 Sponsored by NASA
(NASA-Case-MFS-14017; US-Patent-3,559,937; US-Patent-Appl-SN-762956) Avail: US Patent Office CSCL 14B

A tracking mount for a laser telescope is described having a rotatable base, a yoke mounted on the base, and a bracket mounted for rotation in the yoke. The flexible mounting means is a universal flexure that permits pivotal movements in all directions and is used for altering the azimuthal direction of the telescope. Further, the device is constructed so that the vertical or main optical plane of any telescope mounted on the mounting bracket will not be tilted, but will remain vertical even in the presence of mount deflection. It thus provides for maintaining the direction of the main optical plane of the telescope during 360 degree elevation rotation to better than one arc-second accuracy. A pictorial representation of how this device will be used in tracking a rocket is included.
E.M.C.

N71-26651# Geological Survey, Washington, D.C.
AN EVALUATION OF ANALOG TECHNIQUES FOR IMAGE REGISTRATION
Robert B. McEwen *In its* Geol. Surv. Res. 1970, Chapter D 1970 p D305-D311 refs (See N71-26644 14-13)
Avail: SOD $3.75

Registration of multispectral images of the earth transmitted by three Return Beam Vidicon television cameras carried in a 960-km polar orbit in 1972 by the first Earth Resources Technology Sstellite will require careful calibration of distortion parameters. The parameters, the expected distortions, and the desired calibration accuracies are listed. Four analog techniques considered and evaluated are (1) optical projection and rectification, (2) line-scan modulation, (3) orthophoto image correlation, and (4) analytically controlled transformations of incremental areas. The last offers the best approach for analog image registration
Author

N71-26666# Joint Publications Research Service, Washington, D.C.
LINEAR GAS-DISCHARGE INDICATORS
D. I. Ageykin et al 20 May 1971 9 p refs Transl. into ENGLISH from Prib. Sist. Upr. (Moscow), no. 9, 1969 p 20-22
(JPRS-53182) Avail: NTIS

The design, operating principle, and basic characteristics of the linear gas-discharge indicator are described. The instrument permits continuous visual monitoring of parametric variations and can be used as an electrical measurement instrument in place of dial instruments and digital indicators. An evaluation of the linear gas-discharge indicator suggests that, due to its small dimensions and simplicity of regulation, it can markedly reduce the size of operator instrument panels and also upgrade the quality of information perception.
D.L.G.

N71-26672* National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
METHOD AND APPARATUS FOR DETECTING GROSS LEAKS Patent
John W. Orner, inventor (to NASA) Issued 2 Feb. 1971 4 p Filed 24 Feb. 1969 Cl. 73-49.3; Int. Cl. G01m3/36
(NASA-Case-ERC-10033; US-Patent-3,559,460; US-Patent-Appl-SN-801660) Avail: US Patent Office CSCL 14B

The detection of gross leaks in hermetically sealed devices is accomplished by positioning a displacement transducer on or near a metal surface of the device. The device is placed in a zone wherein the device is subjected to increased gas pressure thereby causing deflection of the surface being sensed by the displacement transducer. If there is a leak in the device, the device will become internally pressurized thereby returning the deflected surface to its original condition. The displacement transducer is employed to sense the deflection of the surface as it occurs.
Official Gazette of the U.S. Patent Office

N71-26774* Ewen Knight Corp., East Natick, Mass.
METHOD AND MEANS FOR PROVIDING AN ABSOLUTE POWER MEASUREMENT CAPABILITY Patent
Harold I. Ewen, George C. Heroules, and Wilfred E. Brown, III, inventors (to NASA) Issued 16 Feb. 1971 7 p 28 Nov. 1967 Cl. 325-363; Int. Cl. H04b1/02; Int. Cl. G01k15/00; Int. Cl. G01r35/00 Sponsored by NASA
(NASA-Case-ERC-11020; US-Patent-3,564,420; US-Patent-Appl-SN-686248) Avail: US Patent Office CSCL 14B

An input circuit for calibrating a relative power measuring radiometer to provide an absolute power measurement capability is described. The input circuit contains reference, switching and coupling devices such that the calibration of the composite absolute temperature measuring radiometer is achieved without the incorporation of cryogenic cooled noise sources as a part of the equipment. The radiometer output indicator zero position corresponds to absolute zero in degrees Kelvin. The injection of noise at a pre-set level in the input signal transmission path provides calibration of the output indicator scale directly in degrees Kelvin.
Official Gazette of the U.S. Patent Office

N71-26788* RCA Service Co., Inc., Camden, N.J.
APPARATUS FOR INSPECTING MICROFILM Patent
Eugene L. Klein, inventor (to NASA) Issued 16 Feb. 1971 5 p Filed 16 May 1969 Cl. 356-203; Int. Cl. G01n21/22 Sponsored by NASA
(NASA-Case-MFS-20240; US-Patent-3,563,668; US-Patent-Appl-SN-825259) Avail: US Patent Office CSCL 14B

A microfilm inspection apparatus is described having reels for transporting microfilm over a light box and rather large magnifying glass for viewing the film for general defects as it moves over the light box. The apparatus has a microscope adjacent to the magnifying glass to obtain detailed inspection of any particular frame of the film. Also, an electrical densitometer is pivotally mounted so as to swing into contact with the film and thereby obtain an accurate determination of the film density.
Official Gazette of the U.S. Patent Office

N71-26789# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
NEUTRON DETECTOR IN SEARCH FOR SUPERHEAVY ELEMENTS IN NATURE
G. M. Ter-Akopyan, M. P. Ivanov, A. G. Popeko, V. G. Subbotin, B. V. Fefilov et al 1970 18 p refs In RUSSIAN
(JINR-P13-6391) Avail: AEC Depository Libraries

The neutron fission detector constructed on the basis of proportional counters filled with He-3 is described. The detector has a sufficiently high sensitivity, small proper background and is meant for measurements of nu (an average number of neutrons per act of fission). The measurements were performed in the shielded places mu < or = 3 is obtained for two samples in which an unknown natural spontaneously fissioning emitter was observed previously.
Author (NSA)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N71-25624# Pennsylvania State Univ., University Park. Materials Research Lab.

QUANTITATIVE SURFACE FINISH CHARACTERIZATION BY CESEMI

Eugene W. White, Herbert A. McKinstry, and Arthur M. Diness 10 Mar. 1971 26 p refs Presented at the Symp. on the Sci. of Ceram. Machining and Surface Finishing

(Contract N00014-67-A-0385-0007)

(AD-719925; TR-4) Avail: NTIS CSCL 14/2

A feasibility for quantitative characterization of surface finishes based on the computer evaluation of scanning electron microscope images (CESEMI) have been established. Measurement of the number, size, shape and orientation of isointensity (or selected intensity interval) regions constitute the basic analysis. Brightness in SEM images varies as a function of the steepness of slope of the surface at a given point. In their analysis, the characteristics of grooves, pits, ridges, etc., can be studied separately. Detailed interpretation of the results are not attempted in this preliminary study. A feasibility for recording and analyzing profilometer rasters have also been demonstrated. Such recordings are, in essence, true three dimensional images of surface topography insofar as the profilometer stylus faithfully follows the surface morphology. Analysis of these profilometer recordings by the basic CESEMI computer programs yield direct descriptions of the topography. The SEM image and profilometer image analyses appear to be complementary techniques. One obvious advantage of the SEM image analysis is that it is a no-contact technique hence, there are no problems introduced by stylus damage. Author (GRA)

N71-25665*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

OPTIMIZATION OF SELF-ACTING HERRINGBONE JOURNAL BEARINGS FOR MAXIMUM RADIAL LOAD CAPACITY

Bernard J. Hamrock and David P. Fleming Washington May 1971 25 p refs

(NASA-TN-D-6351; E-6099) Avail: NTIS CSCL 13I

A computer program was developed to determine optimal herringbone groove parameters for maximum radial load capacity. Design curves enable one to find the optimal herringbone journal bearing for a wide range of operating conditions. These range from incompressible lubrication to a highly compressible condition, for either smooth or groove member rotating, and for length to diameter ratios of 1/4, 1/2, 1, and 2. The analysis valid for small displacements of the journal center from the bearing center and for a large number of grooves. Author

N71-25735*# Aerojet Liquid Rocket Co., Sacramento, Calif.

DESIGN AND EXPERIMENTAL EVALUATION OF A TURBOPUMP LIFT-OFF SEAL Final Report

J. A. Ritter 12 May 1971 99 p refs

(Contract NAS3-11202)

(NASA-CR-72796; ALRC-2100-5) Avail: NTIS CSCL 11A

Hydrogen static zero leakage rates and zero wear rubbing life predictions were developed for various seal interface geometries and material combinations. A hydrostatic lift-off seal and a related tester unit for use with liquid hydrogen were designed and fabricated. The seal was designed for zero leakage of hydrogen after operation which simulated 300 liquid hydrogen turbopump duty cycles. For the seal size studied, zero leakage was defined as one standard cc/sec at a differential pressure of 85 psi. Static sealing and rubbing tests in liquid hydrogen were accomplished in which the seal functioned effectively through a known life of 176 rubbing cycles with leakage below 1 std cc/sec at differential pressures to 45 psi. Author

N71-25839*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FRICTION AND WEAR OF POLY(AMIDE-IMIDE), POLYIMIDE, AND PYRRONE POLYMERS AT 260 C (500 F) IN DRY AIR

William R. Jones, Jr., William F. Hady, and Robert L. Johnson Washington May 1971 17 p refs

(NASA-TN-D-6353; E-6096) Avail: NTIS CSCL 07D

A pin-on-disk sliding friction apparatus was used to determine the friction and wear of a poly(amide-imide), a polyimide, and a pyrrone in dry air at 260 C. Low wear was obtained with a pyrrone, intermediate wear with a polyimide, and very high wear with a poly(amide-imide). All three polymers exhibited low (<0.20) coefficients of friction. The poly(amide-imide) exhibited thermal degradation at 260 C. Experiments were conducted using a hemispherically tipped rider (pure polymer) sliding on a rotating steel disk. Other conditions included a sliding speed of 10 m/min, a 1.5 kg load, and a mineral oil lubricant. Author

N71-25854# Lockheed Missiles and Space Co., Palo Alto, Calif.

INVESTIGATION OF THE COMPENSATING CAPACITY OF A CLUTCH WITH A RUBBER, ELASTIC TOROIDAL ELEMENT

D. N. Reshetov et al [1971] 5 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostr. (USSR), no. 2, 1971 p 25-29

Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Results are presented of testing a clutch with a rubber toroidal elastic element for longevity under conditions of radial and angular shaft displacements and clutch loading by a constant torque. The test stand is described. Author

N71-25975* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

QUICK RELEASE HOOK TAPE Patent

Horace E. Whitacre, inventor (to NASA) Issued 30 Sep. 1969 5 p Filed 6 Feb. 1969 Cl. 24-205.17; Int. Cl. A44b13/00

(NASA-Case-XMS-10860-1; US-Patent-3,469,289; US-Patent-Appl-SN-797056) Avail: US Patent Office CSCL 13E

A quick release mechanism is described for a hook and loop type tape fastener for large areas of mutually rigid surfaces. Rows of pneumatic tubes or strip cams are applied to one of the cooperative rigid surfaces secured by the hook and loop fastener pile. The hook and loop engagement is unhindered when the pneumatic tubes are retracted. The expansion of the pneumatic tubes forces the rigid bases of the two surfaces apart which allows the mutual release of the hook and Astrakhan pile elements. J.M.

N71-26009*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

UNIQUE MANUFACTURING PROCESSES IN SPACE ENVIRONMENT

Apr. 1970 72 p refs Presented at 7th Space Congr., Cocoa Beach, Fla., 23 Apr. 1970

(NASA-TM-X-67178; ME-70-1) Avail: NTIS CSCL 13H

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2. TECHNIQUES AND EXAMPLES FOR ZERO-g MELTING AND SOLIDIFICATION PROCESSES R. T. Frost (GE, Phil., Pa.) 12 p refs (See N71-26011 15-14)

3. SELECTED EXAMPLES FOR SPACE MANUFACTURING PROCESSES, FACILITIES, AND EXPERIMENTS W. H. Steurer (General Dynamics/Convair, San Diego, Calif.) 31 p refs (See N71-26012 15-14)

4. CHEMICAL AND BIOCHEMICAL SPACE

MANUFACTURING C. L. Kober (Martin Marietta Corp., Denver, Colo.) 10 p refs (See N71-26013 15-14)

5. POSITIONING AND HANDLING IN WEIGHTLESS ENVIRONMENT L. H. Berge 8 p refs (See N71-26014 15-14)

N71-26010*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

UNIQUE MANUFACTURING PROCESSES IN SPACE ENVIRONMENT

Hans F. Wuenscher *In its* Unique Manufacturing Processes in Space Environment Apr. 1970 10 p refs (See N71-26009 14-15)

Avail: NTIS CSCL 13H

Processes are discussed and potential materials and products groups are outlined. The space manufacturing experiments presently in development for the Skylab orbital workshop mission are briefly described, and NASA plans and the industrial participation in space processing and manufacturing experiments are outlined. Author

N71-26011*# General Electric Co., Philadelphia, Pa. Earth-Orbit Applications Programs.

TECHNIQUES AND EXAMPLES FOR ZERO-g MELTING AND SOLIDIFICATION PROCESSES

R. T. Frost *In* NASA. Marshall Space Flight Center Unique Manufacturing Processes in Space Environment Apr. 1970 12 p refs (See N71-26009 14-15)

Avail: NTIS CSCL 13H

Processes which can exploit the weightless environment of space were suggested as possibilities for making improved or unique materials. A large number of these will involve, at some stage, a containerless melt or transfer of molten material. Some of the physics and technology problems associated with these processes are discussed. The range of applicability of some new electromagnetic process control methods is also presented. Author

N71-26012*# General Dynamics/Convair, San Diego, Calif.

SELECTED EXAMPLES FOR SPACE MANUFACTURING PROCESSES, FACILITIES, AND EXPERIMENTS

Wolfgang H. Steurer *In* NASA. Marshall Space Flight Center Unique Manufacturing Processes in Space Environment Apr. 1970 31 p refs (See N71-26009 14-15)

Avail: NTIS CSCL 13H

A number of promising processes and the related product capabilities are discussed. Based on an evaluation of process effectiveness and facility requirements, an example for a potential three-phase space experiment program is presented. Author

N71-26013*# Martin Marietta Corp., Denver, Colo.

CHEMICAL AND BIOCHEMICAL SPACE MANUFACTURING

Carl L. Kober *In* NASA. Marshall Space Flight Center Unique Manufacturing Processes in Space Environment Apr. 1970 10 p refs (See N71-26009 14-15)

Avail: NTIS CSCL 13H

Potential and possible space manufacturing processes are characterized by the fact that the reaction energies involved are of similar or equal magnitude as the gravitational energies of the reactants in one-g. Scaling laws are developed to allow the steps from small to larger production units. Gibbs functions for the processes are shown in order of magnitude. They are small amounts of energies, serving as triggers for chemical reactions, otherwise suppressed by gravitational energies. On this basis, 37 new product classes for zero-g manufacturing are described, such as vaccines. Author

N71-26014*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

POSITIONING AND HANDLING IN WEIGHTLESS ENVIRONMENT

L. H. Berge *In its* Unique Manufacturing Processes in Space Environment Apr. 1970 8 p refs (See N71-26009 14-15)

Avail: NTIS CSCL 13H

Several electro-mechanical devices to transfer, position, and retrieve space manufacturing equipment are discussed. Application to an orbital manufacturing facility is described. Author

N71-26044*# Whittaker Corp., San Diego, Calif. Research and Development Div.

EXOTHERMIC BRAZING SPECIMENS Final Report, 22 Jun. 1967 – 31 Dec. 1970

31 Dec. 1970 52 p

(Contract NAS8-20829)

(NASA-CR-103169) Avail: NTIS CSCL 13H

The design, optimization, and fabrication of exothermic braze units for repair and assembly of stainless steel materials on space missions are discussed. The units had to be lightweight, compact, compatible with space environments and easily handled by astronauts during space operations. All objectives of the program were successfully completed including fabrication of final flight hardware. Author

N71-26045*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INFLUENCE OF ALUMINUM ON FRICTION AND WEAR OF IRON-ALUMINUM ALLOYS DRY AND LUBRICATED

Donald H. Buckley Washington May 1971 17 p refs

(NASA-TN-D-6359; E-6157) Avail: NTIS CSCL 11H

Sliding friction experiments were conducted with iron-aluminum alloys, unlubricated and lubricated, in an argon atmosphere. The alloys contained 10-, 20-, 25-, and 50 atomic percent aluminum. Friction and wear were measured for dry sliding, sliding in hexadecane, and sliding in hexadecane containing various concentrations of stearic acid. Results of the study indicate that the addition of 10 atomic percent aluminum to iron results in an increase in friction and wear in dry sliding and when hexadecane is presented. The aluminum undergoes equilibrium segregation to the surface. Aluminum increases surface reactivity with stearic acid. Order-disorder reactions were masked by surface segregation effects. Author

N71-26134* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

WELD PREPARATION MACHINE Patent

Elvis D. Wallace, inventor (to NASA) Issued 12 Jan. 1971 3 p Filed 30 Apr. 1968 Cl. 51-170; Int. Cl. B24B23/02, 23/08; Int. Cl. B23c3/02

(NASA-Case-XKS-07953; US-Patent-3,553,904; US-Patent-Appl-SN-725406) Avail: US Patent Office CSCL 13H

A portable cutting machine is described for preparing the ends of piping to be welded in the field is described. The portable cutting machine includes a guiding table and roller assembly which provide proper location and orientation of the piping being prepared for end welding. Official Gazette of the U.S. Patent Office

N71-26143*# Massachusetts Inst. of Tech., Cambridge. Dept. of Naval Architecture and Marine Engineering.

ANALYSIS OF THERMAL STRESS AND METAL MOVEMENT DURING WELDING Final Report

J. B. Andrews, M. Arita, and K. Masubuchi 15 Dec. 1970 279 p refs

(Contract NAS8-24365)

(NASA-CR-61351; Rept-71-1) Avail: NTIS CSCL 13H

The development of an analytical system for calculating thermal stresses during welding and resulting residual stresses is outlined. A general discussion of the analysis and control of

distortion during welding fabrication of structures is given. A theoretical discussion is presented on the calculation of the welding stresses, beginning with some general aspects of the problem. The theoretical background necessary for both the calculation of temperature and stress distribution is outlined. The analysis concerns only longitudinal stresses, that is, stresses in the direction parallel to the weld line. Computer programs developed are appended. The effects of material properties and welding parameters on thermal stresses and metal movement are discussed. The materials studied include aluminum, steel, columbium, and tantalum. A detailed analysis was made of effects of welding parameters on thermal stresses during bead-on-plate welding of 2219-0 aluminum. Temperature and strain changes were recorded during bead-on-plate welding of 2219-0 aluminum alloy plates 30 inches long, 18 inches wide, and 1/4 inch thick. Measured temperature and strain changes were compared with those calculated with the computer programs. Author

N71-26145* National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

LAYOUT TOOL Patent

Robert G. Green, inventor (to NASA) Issued 16 Feb. 1971 4 p Filed 29 Aug. 1968 Cl. 33-189; Int. Cl. B23b49/02
(NASA-Case-FRC-10005; US-Patent-3,562,919;
US-Patent-Appl-SN-756266) Avail: US Patent Office CSCL 13I

A compact layout tool for machine shop use to locate a point in precise relationship to a straight or arcuate reference edge is described. The tool comprises a straight edge blade, and a parallelogram structure mounted on the blade. Two of the opposite corners of the parallelogram structure are held on the straight edge, one pivotally joined thereto and the other constrained to movement therealong. The other two corners lie on opposite sides of the straight edge, and a pair of pins is mounted outwardly of these corners. When the pins engage a reference edge, the straight edge blade extends perpendicular to the reference edge. The parallelogram structure can be opened for large workpieces, and can be collapsed for carrying the tool in a shirt pocket.
Official Gazette of the U.S. Patent Office

N71-26148* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

METHOD AND APPARATUS FOR PRECISION SIZING AND JOINING OF LARGE DIAMETER TUBES Patent

Robert J. Schwinghamer and J. D. Bennight, inventors (to NASA) Issued 19 Jan. 1971 12 p Filed 27 Jun. 1969 Cl. 72-56; Int. Cl. B21d26/14 Continuation-in-part of US Patent Appl. SN-637882, filed 27 Jun. 1969
(NASA-Case-XMF-05114-2; US-Patent-3,555,867;
US-Patent-Appl-SN-837377) Avail: US Patent Office CSCL 13I

A method and apparatus for portable high precision magnetomotive bulging, constricting, and joining of large diameter tubes are discussed. The method allows decremental, very accurate changing of the diameter of very large tubes, as well as high quality joints obtained by either bulging or constricting overlapping ends of two tubes. The apparatus consists of a magnetomotive coil positioned either inside or outside of the tube and a non-conducting mandrel (or forming die) on the other side. The magnetomotive coil has square conductors which are recessed, and thus separated by an air gap, from the tube. The constricting coil has a split metal sleeve for withstanding hoop stress. The tube (workpiece) is insulated from the coil by a thin plastic sleeve. The power supply is an electrically floating system.
Official Gazette of the U.S. Patent Office

N71-26162* North American Rockwell Corp., Downey, Calif.

LATCHING MECHANISM Patent

Jacob C. Cobin and Leo L. Rhodes, inventor (to NASA) Issued 16 Feb. 1971 14 p Filed 21 Nov. 1969 Cl. 24-263; Int. Cl. A44b21/00 Sponsored by NASA
(NASA-Case-MSC-15474-1; US-Patent-3,564,564;
US-Patent-Appl-SN-878731) Avail: US Patent Office CSCL 13E

A latch for latching docking rings on a space vehicle is described. It includes a latching hook connected to a stored energy power package, such as a spring, and a cocking handle which simultaneously unlatches the hook and stores energy in the power package. It also includes triggering means to properly position the hook and to retain the look in the cocked position until released at the desired time. Official Gazette of the U.S. Patent Office

N71-26186* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

FILTER SYSTEM FOR CONTROL OF OUTGAS CONTAMINATION IN VACUUM Patent

Bobby W. Kennedy, inventor (to NASA) Issued 26 Jan. 1971 4 p Filed 8 Nov. 1968 Cl. 55-75; Int. Cl. B01d53/04
(NASA-Case-MFS-14711; US-Patent-3,557,534;
US-Patent-Appl-SN-774266) Avail: US Patent Office CSCL 13K

A filter system for control of outgas contamination of equipment assemblies in the space environment is described. Components subject to outgassing are enclosed in a sealed container vented externally through a filter having absorbent beds of a molecular sieve zeolite, silica gel and charcoal. Contamination of exposed optical surfaces with deposits derived from outgas fragments is prevented by this means.
Official Gazette of the U.S. Patent Office

N71-26189* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ROLLING ELEMENT BEARINGS Patent

Dean C. Glenn, inventor (to NASA) Issued 9 Feb. 1971 3 p Filed 10 Apr. 1969 Cl. 308-187; Int. Cl. F16c33/66 Continuation-in-part of US Patent Appl. SN-686344, filed 17 Mar. 1970
(NASA-Case-XLE-09527-2; US-Patent-3,561,828;
US-Patent-Appl-SN-840870) Avail: US Patent Office CSCL 13I

An improved rolling element bearing for use in ultrahigh vacuum environments is described. The bearing has rolling elements positioned by a retainer or cage fabricated from a porous metal. A solid lubricant is burnished on the components to eliminate the loss of lubrication in the vacuum environment.
Official Gazette of the U.S. Patent Office

N71-26192# Picatinny Arsenal, Dover, N.J.

VIBRATION FATIGUE STUDY OF ELASTOMERIC SHEAR MOUNTS

Eugene Farrell and Karl Jensen Feb. 1971 42 p refs
(AD-720575; PA-TR-4107) Avail: NTIS CSCL 13/5

A method of measuring the fatigue life of elastomeric shear mounts was developed. It included vibration testing at resonance to failure at different inputs, and plotting the time to failure vs input displacement for each set of mounts tested. Twelve pairs of mounts composed of butadiene styrene elastomer were subjected to static load deflection and vibration testing. The nominal static spring rate of one mount was 470 pounds/in. The load deflections yielded results within 7% of this value. During initial vibration the transmissibility was found to vary between 3.1 and 4.4 and the resonant frequency between 8.4 and 9.2 Hz. Eleven pairs of mounts were fatigue-vibrated at double amplitudes (DA) of 1/8 in, 0.2 in, 1/4 in and 1/2 in. The durations to failure were approximately four hours for 1/8 inch and five minutes for 1/2 inch. What actually constitutes failure in a shear mount has been a matter of concern for some time. After investigating changes, if any, in frequency, transmissibility, etc, failure were defined as a visual tear or separation of the mount. Upon completion of the fatigue vibration testing, five pairs of mounts were again subjected to load deflection testing. The loss of static spring rate amounted to less

than 15% for all five deflected up to 3 inches, and in most cases it was less than 10%. Author (GRA)

N71-26224*# LTV Aerospace Corp., Dallas, Tex. Missile and Space Div.
FEASIBILITY DEMONSTRATION OF A SPRAYING FLASH EVAPORATOR Final Report
J. L. Gaddis 7 May 1971 141 p refs
(Contract NAS9-11254)
(NASA-CR-114913; VMSC-00-1427) Avail: NTIS CSCL 13H

An effort to demonstrate the feasibility of a direct spray flash evaporator concept for environmental control system application is reported. Included are analytical studies of particle freezing, evaporation on the wall, and controls. Analytical uncertainties were resolved by experimental data in a preliminary test. A documentation test of two evaporator configurations rejected 25,000 BTU/hr from an active transport loop using H2O, Freon 22, and NH3 as evaporants. Evaporant efficiences of over 90% were achieved and outlet temperature control by evaporant pulsing was performed. Author

N71-26243* General Motors Corp., Detroit, Mich.
HEREMETIC SEALED VIBRATION DAMPER Patent
Donald G. Wheatley, inventor (to NASA) Issued 7 Jan. 1969 4 p Filed 1 May 1968 Cl. 188-1; Int. Cl. F16d63/00 Sponsored by NASA
(NASA-Case-MSC-10959; US-Patent-3,420,338; US-Patent-Appl-SN-725719) Avail: US Patent Office CSCL 13E

A fluid damper for lessening axial shock and vibration between supporting gimbals of a gyroscopic device is described which is composed of an annular channel through which one gimbal is journalled for free rotation, and an annular orifice plate surrounding the channel in sliding relationship thereto to which the cooperating gimbal is attached. A flexible bellows connected between the orifice plate and the channel contains a volume of damping fluid within the channel so that any axial movement between gimbals forces the fluid to pass through the orifices in the plate and the restricted space between the plate and channel, thus providing the desired damping. Official Gazette of the U.S. Patent Office

N71-26246# Mechanical Technology, Inc., Latham, N.Y.
DEVELOPMENT OF GEAR FAILURE DETECTION METHODS Technical Report, 1 Jul. 1968 – 31 Dec. 1970
John L. Frarey 31 Dec. 1970 59 p refs Prepared in part by GE Co.
(Contract N00014-68-C-0455)
(AD-720735; MTI-70TR76) Avail: NTIS CSCL 13/9

The objective of the program was to develop detection methods and to test the capability of these methods to provide information on the mechanical failures of gearing systems. Gear wear was the failure mechanism selected for this first phase of this effort. An analytical method was used to predict the amplitude ratios of the first three harmonics of the gear mesh vibrational frequencies as a function of tip wear in a set of test gears. These gears were then operated and the amplitude ratios were measured using a detector. Reasonably good correlation between predicted and measured values was obtained for the 3/1 ratio. Poor correlation was obtained for 2/1 ratio. This technique shows promise as a method of monitoring gear wear. Author (GRA)

N71-26294* Aerojet General Corp., Glendale, Calif.
ROTATING SHAFT SEAL Patent
Robert L. Lessley and George B. Bosco, Jr., inventors (to NASA) Issued 23 Sep. 1969 4 p Filed 6 Jun. 1966 Cl. 277-13; Int. Cl. F16k15/40, 15/54 Sponsored by NASA
(NASA-Case-XNP-2862-1; US-Patent-3,468,548; US-Patent-Appl-SN-556830) Avail: US Patent Office CSCL 11A

A liquid-vapor interface type of seal for the rotating shaft of a turbine utilizing mercury as the working fluid is disclosed. The seal includes three pumps extending between the shaft and the housing from the high-pressure turbine cavity to a low-pressure vented area. The pumps are adapted to pump liquid or vapor upon rotation of the shaft. First pump comprises a helical groove extending from the cavity to a slinger pump housed in a slinger space. The first pump is adapted to pump mercury vapor from the cavity toward the slinger space. The slinger pump tends to pump in the opposite direction of the first pump. The mercury vapor in the first pump and the slinger space is cooled and condensed to liquid by flowing coolant liquid through a passage in the housing or by injecting cooled mercury into the seal. A liquid-vapor interface is formed in the slinger space and leakage of mercury vapor toward the vent is further restricted by means of a molecular pump in the form of a second helical groove extending from the vent to the slinger space and is adapted on rotation of the shaft to pump mercury molecules toward said interface.
Official Gazette of the U.S. Patent Office

N71-26310# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RUN IN AND WEAR RESISTANT COATINGS FOR MACHINE PARTS MADE OF ALUMINUM ALLOYS
M. E. Goldshtein et al 29 Dec. 1970 12 p Transl. into ENGLISH from Tekhnol. Organizatsiya Proizv. (USSR), no. 5, 1969 p 28–30
(AD-720742; FTD-HT-23-820-70) Avail: NTIS CSCL 11/3

Electrolytic processes were developed for applying a lead-tin coating on the effective area of aluminum monometallic and bimetallic bearings of various engines. Depending upon the composition of the alloy from which the bearings have been made, various methods of preparing the surfaces of aluminum alloys before the application of the run-in coatings were investigated and employed. In order to eliminate the phenomenon of gripping of the steel bearing surface of bimetallic bearings with coupled surfaces of the unit, a process of chemical nickelizing is employed. Author (GRA)

N71-26312* Eitel-McCullough, Inc., San Carlos, Calif.
METHOD OF FORMING CERAMIC TO METAL SEAL Patent
Leonard Reed, inventor (to NASA) Issued 2 Dec. 1969 6 p Filed 25 Jan. 1968 Cl. 287-189.365; Int. Cl. E16b11/00 Continuation-in-part of US Patent Appl. SN-330211, filed 13 Dec. 1963 Sponsored by NASA
(NASA-Case-XNP-01263-2; US-Patent-3,481,638; US-Patent-Appl-SN-718279) Avail: US Patent Office CSCL 11A

A method of forming ceramic to metal hermetic seals is discussed. A sintered metalized layer on the ceramic body is coated with sintered iron prior to brazing a second metal body on the layer. Official Gazette of the U.S. Patent Office

N71-26346* Aerojet General Corp., El Monte, Calif.
HYDROFORMING TECHNIQUES USING EPOXY MOLDS Patent
Robert N. Hanson, inventor (to NASA) Issued 19 Aug. 1969 5 p Filed 27 Dec. 1966 Cl. 72-61; Int. Cl. B21d26/16, 22/10 Sponsored by NASA
(NASA-Case-XLE-05641-1; US-Patent-3,461,700; US-Patent-Appl-SN-605091) Avail: US Patent Office CSCL 13H

A hollow workpiece is disposed inside a thin-walled die inside a pressure vessel. Fluid pressure is applied to the inside of the workpiece and to the outside of the die so that pressure forces across the die are balanced. The interior of the workpiece is sealed from the interior of the pressure vessel. Additionally, the whole die is sealed in a hermetic pliable bag to prevent leakage of fluid from the pressure vessel through the die into the space between the workpiece and the die. A one way valve is provided

in the bag for attachment to a vacuum pump.
Official Gazette of the U.S. Patent Office

N71-28439# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
POSSIBILITY OF COOLING WITH SUPERFLUID HELIUM IN TUBULAR SYSTEMS, FOR EXAMPLE, SUPERCONDUCTING HELIX WAVEGUIDES [MOEGLICHKEITEN DER KUEHLUNG MIT SUPERFLUIDEM HELIUM IN ROHRSYSTEMEN, Z.B. AUCH VON SUPRALEITENDEN HELIX-WELLENLEITERN]
C. Passow Dec. 1969 48 p refs In GERMAN; ENGLISH summary
(NP-18651) Avail: AEC Depository Libraries

The technical feasibility of using superfluid helium with its high heat conductivity for cooling systems at temperatures between 1 K and 2 K is investigated theoretically. It is shown mathematically that the two-fluid model, which describes well the conductivity in capillaries and slits of very small dimensions, should be applicable in calculations for large-scale cooling systems also. On this basis, calculations for two different cooling systems are performed. In the first system there is no mass transport of helium. Therefore, the heat transport is due to the circulations in the pipe of the two quantum states, the superfluid and the normal fluid. In the second system the helium is pumped with small pressure through the system. Through a superleak, pure superfluid helium is fed to the heat source. The cooling system treated can be used, for example, to cool superconducting accelerator structures, especially helical waveguides. Numerical calculations for this application were made. Author (NSA)

N71-28568*+ Almay Research and Testing Corp., Los Angeles, Calif.
DEVELOPMENT OF TECHNOLOGY FOR INSTALLATION OF MECHANICAL FASTENERS
Harry S. Brenner [1969] 788 p refs
(Contract NAS8-20779)
(NASA-CR-103179) Avail: NTIS HC $9.00 CSCL 13E

The results of a study program investigating the variables affecting and influencing joint pre-load (or clamp load) properties of installed structural bolts and nuts as employed in the fabrication and construction of launch and space vehicles are summarized. The objective of this study was the establishment of reliable installation technology and torque-tension values for the various bolt-nut combinations included in the project. The study indicated that installation torque values intended to develop desired induced bolt clamp loads are essentially valid only for the initial application. Repetitive use of the same nut-bolt assembly at the objective design installation torque results in a continuing loss of induced clamp load through 15 cycles. The data indicated that clamp loads were influenced by variable such as hole size and lubrication. Author

N71-28611* Grumman Aircraft Engineering Corp., Bethpage, N.Y.
RADIATOR DEPLOYMENT ACTUATOR Patent
Hans M. Kolstee and William E. Simpson, inventors (to NASA) Issued 16 Feb. 1971 5 p Filed 2 Feb. 1970 Cl. 165-86; Cl. 244-1; Cl. 244-57; Cl. 165-44; Cl. 188-88; Int. Cl. F28d11/00
Sponsored by NASA
(NASA-Case-MSC-11817-1; US-Patent-3,563,307; US-Patent-Appl-SN-007668) Avail: US Patent Office CSCL 13I

An apparatus for mounting a radiator or other fluid-communicated vessel for hinged movement is described. The apparatus includes a fluid line formed of spring material which is coiled within a housing and tends to uncoil for deployment of the radiator. The rate of deployment is controlled by a damping means within the housing. Official Gazette of the U.S. Patent Office

N71-28635* National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
ELECTROMECHANICAL CONTROL ACTUATOR SYSTEM Patent
Hubert F. A. Tschunko, inventor (to NASA) Issued 27 Apr. 1971 7 p Filed 7 Nov. 1969 Cl. 74-89.15; Cl. 74-424.8; Int. Cl. F16h27/02; Int. Cl. F16h1/05
(NASA-Case-ERC-10022; US-Patent-3,576,135; US-Patent-Appl-SN-874733) Avail: US Patent Office CSCL 13I

A motion-transmitting device utilizing a double differential screw principle is disclosed. One differential screw mechanism including first and second sets of threads of different pitch is operatively coupled to another differential screw mechanism having third and fourth sets of threads of different pitch. By providing the first and second sets of threads with a pitch difference not equal to the difference in pitch between the third and fourth sets of threads, a double differential movement is established.
Official Gazette of the U.S. Patent Office

N71-28660# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF PRESSURE DISTRIBUTION IN SLIDE BEARING BY THE PHOTOELASTICITY METHOD
A. I. Korolev et al 22 Dec. 1970 17 p refs Transl. into ENGLISH from Kuznechno- Shtampovochnoe Proizvod. (Moscow), v. 12, no. 2, 1970 p 25-28
(AD-720746; FTD-MT-24-280-70) Avail: NTIS CSCL 13/9

The real character of distribution of contact pressures in slide bearings, linings of which are made from the new materials with low modulus of elasticity, substantially differs from the character of distribution of pressures in bearing pairs, bushing of which are made from the same material as journals. Utilization of new materials in slide bearings leads to growth of maximum pressures, affecting the contact surfaces of linings and journals. However, the amount of maximum pressure in a slide bearing, lining of which is made from material with maximum low modulus of normal elasticity, in all only 1.2 times exceeds the greatest pressure in the bearing with lining and journal from similar material. This circumstance confirms the possibility of successful operation of linings from new materials in slide bearings of machines. Author (GRA)

N71-28673* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OPTICAL MACHINE TOOL ALIGNMENT INDICATOR Patent
Alfred G. Boissevain and Byron W. Nelson, inventor (to NASA) Issued 23 Feb. 1971 5 p Filed 28 Dec. 1967 Cl. 356-154; Int. Cl. G01b11/26, 11/02, 9/08
(NASA-Case-XAC-09489-1; US-Patent-3,565,530; US-Patent-Appl-SN-694246) Avail: US Patent Office CSCL 13I

An optical gauging instrument is described for checking the alignment of a machine element such as the electrode of an electrical discharge machine, comprising a light source which provides a beam of light projected along a path to fall upon a viewing screen. The electrode is located in the path of the beam whereby an image thereof is projected on the screen. A lens, or lenses, are positioned between the light source and electrode to concentrate the beam on the electrode, and a projection lens may be positioned between the electrode and screen for producing an enlarged image on the screen. The screen preferably is movable and may be positioned at an oblique angle with the optical axis of the system for further enlargement of the electrode image.
Official Gazette of the U.S. Patent Office

N71-28721* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DIELECTRIC MOLDING APPARATUS Patent
Charles B. King, Robert T. Swann, and Martin J. Menges, inventors (to NASA) Issued 16 Feb. 1971 9 p Filed 9 Oct. 1968 Cl.

18-6; Int. Cl. B29c1/12; Int. Cl. H05b1/00
(NASA-Case-LAR-10121-1; US-Patent-3,562,857; US-Patent-Appl-SN-766244) Avail: US Patent Office CSCL 13H

An apparatus is described for the dielectric heating, fusing, and hardening of an organic matrix to form plastic materials into a product having a desired molded shape. It is designed to provide a method for quickly and accurately molding and curing plastic materials having frangible particles without rupturing the particles. A means of quality control of the cure stage is accomplished by monitoring the parameters of temperature, pressure, and evolved gas composition. D.L.G.

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N71-25618# Northrop Corporate Labs., Hawthorne, Calif. Electromagnetic Lab.
CO2 LASER PULSING TECHNIQUES Semiannual Report
M. M. Mann 28 Feb. 1971 17 p refs
(Contract N00014-70-C-0185; ARPA Order 306)
(AD-719917; NCL-71-15R) Avail: NTIS CSCL 20/5

Simultaneous mode locking and pulse coupling of a CO2 laser has been achieved using a single internal GaAs element with electrodes on both the (001) and (110) faces. Coupling of pulses from the laser did not affect the stability of the mode locked pulse train. Possible application of the technique to pulse code modulation of the CO2 laser is discussed. Author (GRA)

N71-25625# Sylvania Electronic Systems-West, Mountain View, Calif. Electro-Optics Organization.
AMPLITUDE-STABILIZED PULSED LASER Annual Report, 29 Jun. 1970 - 29 Jan. 1971
William D. Fountain and Ronald L. Hansen 26 Feb. 1971 30 p refs
(Contract N00014-70-C-0342; ARPA Order 306)
(AD-719931; EOO-18) Avail: NTIS CSCL 20/5

The report summarizes the results during the reporting period of a program whose goal is the development of a flash-pumped, Q-switched, mode-locked, cavity-dumped, amplitude-stabilized laser operating at approximately 1.06 micrometers in the fundamental transverse TEM sub oo mode. System design is presented, and also test results for those parts of the system which have been completed and tested. Author (GRA)

N71-25844# Aerospace Corp., El Segundo, Calif. Lab. Operations.
ANALYTICAL MODEL FOR A CONTINUOUS CHEMICAL LASER, JUNE 1969 - JUNE 1970
George Emanuel 30 Sep. 1970 86 p refs
(Contract F04701-70-C-0059)
(AD-720794; TR-0059(6240-20)-3; SAMSO-TR-70-379) Avail: NTIS CSCL 20/5

A simplified theoretical analysis of a continuous chemical laser is presented, primarily to acquaint the reader with the constant-gain method of solution and to emphasize the strong coupling in the cavity between the radiation and the chemistry. Lasing is assumed to occur in a Fabry-Perot cavity on vibration-rotation transitions between two vibrational levels of a hypothetical diatomic molecule. A Boltzmann distribution is assumed for the rotational populations, thereby further restricting lasing to the maximum gain transition in the P-branch. New features in this study include: (1) An analysis of J-shifting in which lasing shifts from one rotational transition to the next; (2) A demonstration that the closed cavity condition, wherein the mirrors are perfectly reflecting, is an indeterminate limit with a finite output power; (3) A comprehensive parametric analysis that indicates that a high lasing efficiency might be attainable under certain operating conditions. Author (GRA)

N71-25874# Bell and Howell Research Center, Pasadena, Calif. Electronic Materials Div.
DEVELOPMENT OF GaAs INFRARED WINDOW MATERIAL Technical Summary Report, 1 Dec. 1969 - 30 Nov. 1970
Alan G. Thompson Dec. 1970 51 p refs
(Contract N00014-70-C-0132; ARPA Order 306)
(AD-720390) Avail: NTIS CSCL 20/6

The choice of a window material suitable for high power CO2 lasers emitting at 10.6 microns is discussed. Gallium arsenide was chosen as the primary candidate with gallium antimonide being the object of a subsidiary investigation. The preparation of GaAs is discussed at length. The physical, electrical and optical properties of GaAs are also discussed with particular reference to the high-resistivity form which is necessary to reduce free-carrier absorption at 10.6 microns to an acceptable level. The method used to measure the optical absorption coefficient is a calorimetric one making use of a low power CO2 laser. The variation of the optical absorption coefficient with impurities, different dopants and resistivity was examined. Author (GRA)

N71-25914* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LASER CALIBRATOR Patent
Stuart L. Seaton, inventor (to NASA) Issued 23 Sep. 1969 4 p Filed 8 Dec. 1965 Cl. 250-199; Int. Cl. H04b9/00; Int. Cl. G01r29/22
(NASA-Case-XLA-03410; US-Patent-3,469,087; US-Patent-Appl-SN-512561) Avail: US Patent Office CSCL 20E

A device for measuring the power output of a laser is described. The laser beam is directed into a piezoelectric crystal and the resulting output from the crystal measured. In one embodiment the voltage output is measured and in another the change in the natural frequency of the crystal is measured. Official Gazette of the U.S. Patent Office

N71-25961# General Telephone and Electronics Labs., Inc., Bayside, N.Y.
HIGH ENERGY PULSED LIQUID LASER Semiannual Technical Summary Report, Jul. 1970 - 31 Jan. 1971
Harold Samelson, Alexander Lempicki, and Robert Kocher 28 Feb. 1971 55 p refs
(Contract N00014-68-C-0110)
(AD-720393; GT/E-TR-71-826.2) Avail: NTIS CSCL 20/5

The report describes the design and fabrication of a Q-switched oscillator and a long-pulse oscillator/amplifier based on the solution Nd+3:ZrCl4POCl3 as the active medium. Improvements in these two laser units include liquid filter elements in the circulatory system and new pump seal designs. An additional new feature is incorporation of a two-temperature cooling system capable of dissipating the excess input power so that sustained operation can result and, at the same time, control the radial gradients in the active medium so that an axial gradient device can be obtained. Extensive experiments at an output level of 40 to 60 watts are described. In these experiments a liquid laser was operated with the same solution for a period of months. The liquid pump received thorough testing, and the mercury seal concept was found acceptable. In addition, the efficacy of filtering the laser liquid was clearly demonstrated. Finally, some initial experiments were done in the area of hole drilling and welding. Author (GRA)

N71-26008# Naval Weapons Lab., Dahlgren, Va.
THE NAVAL WEAPONS LABORATORY LASER RANGERY TRACKER SYSTEM
N. Norbert Harold Nov. 1970 51 p refs
(AD-720351; NWL-TR-2469) Avail: NTIS CSCL 17/8

A working breadboard model of a laser-based missile tracking and ranging system was designed and developed. The system was evaluated under actual rnge conditions where it was demonstrated its capabilities in tracking 2.75- and 5-inch rockets over the initial portion of their flights. The system is a self-contained mobile unit containing several subsystems. Each subsystem is an independent unit in that it can be modified to meet specific requirements without affecting other subsystems. Sufficient flexibility is inherent in the system to render it useful as a research tool or as a standard range instrumentation item. Author (GRA)

N71-26031# International Business Machines Corp., Gaithersburg, Md. Federal Systems Div.

MOLECULAR LASER STUDY 3-5 MICRONS Semiannual Technical Status Report, 1 Aug. 1970 - 31 Jan. 1971

Bernard G. Huth 31 Jan. 1971 38 p refs

(Contract N00014-71-C-0010; ARPA Order 306)

(AD-720404) Avail: NTIS CSCL 20/5

The report presents some pertinent background on molecular lasers in the form of a brief review of N2-CO2-He lasers and the operation of plasma tubes. Discussion of laser emission from a mixture of H2-C2H2-He is presented. The operation of the first acetylene laser and identification of the lasing transition were performed. GRA

N71-26154* National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.

METHOD AND MEANS FOR RECORDING AND RECONSTRUCTING HOLOGRAMS WITHOUT USE OF A REFERENCE BEAM Patent

Lowell Rosen, inventor (to NASA) Issued 17 Nov. 1970 3 p Filed 29 Feb. 1968 Cl. 350-3.5; Int. Cl. G02b27/22

(NASA-Case-ERC-10020; US-Patent-3,540,790; US-Patent-Appl-SN-709399) Avail: US Patent Office CSCL 20E

Halograms, having quite unique properties, are made by angularly positioning the object with respect to the photographic plate such that laser lighter scattered from one portion of the object serves as the reference beam for the laser beam scattered from another portion of the object on the photographic plate. Reconstruction of the recorded hologram is accomplished by placing the reconstruction source (point or extended coherent or point or extended incoherent) at a position approximately duplicating the center position of the portion of the object which was furthest from the photographic plate during the recording process. Official Gazette of the U.S. Patent Office

N71-26188# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

LASER SYSTEMS, AIRBORNE Final Report

14 Jan. 1971 33 p refs

(AD-720552; MTP-6-3-166) Avail: NTIS CSCL 1/3

Procedures are described for evaluating the suitability of airborne laser systems for Army use. Laser applications, including terrain mapping, range finding, communication, and fire control, are discussed. Laser system safety considerations are given detailed treatment. Author (GRA)

N71-26313 California Univ., Berkeley.

VIBRATIONAL ENERGY DISTRIBUTION IN REACTION PRODUCTS AND CHEMICAL REACTIVITY OF EXCITED SPECIES THROUGH CHEMICAL LASER STUDIES

John Hilliard Parker (Ph.D. Thesis) 1969 144 p

Avail: Univ. Microfilms Order No. 70-6188

Analyses of two different types of laser systems -- the atomic iodine photodissociation laser and the UF6-H2 hydrogen fluoride chemical laser -- were performed and the important processes occurring were identified. These studies led to the discovery of a new group of HF chemical lasers, the hydrogen atom abstraction lasers. A method for determining the vibrational energy distribution among the products of an exothermic reaction was developed. Atomic iodine laser emission was observed in the flash photolysis of C2F5I, 1-C3F7I, 2-C3F7I, 1-C4H9I and isobutyl iodide. The absence of laser emission in the flash photolysis of 2-C3H7I was investigated. A thorough study of the CF3I laser has shown the relative importance of the various chemical reactions operating in that system. An investigation of the quenching of iodine laser emission from CF3I by added I2 was made, and the rate of deactivation of I(2P1/2) by I2 was measured. The temperature rise that occurs during the time of emission was determined. Dissert. Abstr.

N71-26419*# Alabama University, University. Bureau of Engineering Research.

STUDY OF ATMOSPHERIC EFFECTS ON LASER COMMUNICATIONS SYSTEMS. VOLUME 2: ATMOSPHERIC EFFECTS ON WAVE PROPAGATION AT 10.6 MICRONS Interim Report

William E. Webb and Kermit H. George Mar. 1971 107 p refs

(Contract NAS8-25562)

(NASA-CR-103113; BER-130-70-Vol-2) Avail: NTIS CSCL 20E

The statistical properties of scintillation and the signal-to-noise ratio of heterodyne detection for a CO2 laser beam propagated over a 3.2 km path are experimentally investigated. Both scintillation and heterodyne measurements were made for a variety of receiving aperture sizes ranging from two to ten cm. The necessary statistical concepts are introduced before a qualitative description of atmospheric turbulence is given. In addition, the physical significance of aperture averaging is discussed. A description is given of the equipment, its alignment and check out as well as a discussion on the techniques used to make the measurements. Data reduction includes the conversion of analog data to digital form for direct use on a digital computer, also an outline of the computer program. Discussions are introduced with the purpose of determining if the hypothesis of the log-normal distribution for intensity scintillation is valid for the wavelength investigated. Also, calculations for the refractive index structure constant with and without aperture averaging corrections are included. E.M.C.

N71-26453# Joint Publications Research Service, Washington, D.C.

THE APPLICATION OF LASERS FOR THERMONUCLEAR SYNTHESIS

N. G. Basov *In its* Vestn. of the USSR Acad. of Sci., Vol. 40, No. 6, 1970 31 Aug. 1970 p 64-75 ref (See N71-26452 14-30)

Avail: NTIS

Pulsed laser generation of heated plasmas is studied and it is shown that large energy increases can be obtained only provided that a portion of the liberated energy in the thermonuclear reaction is used directly for heating the new portions of plasmas. Ultrashort neodymium laser pulses heat a deuterium-lithium plasma to 10-20 million degrees; an emission of neutrons forming in the hot dense plasma as a result of thermonuclear reactions is observed. G.G.

N71-26570# Army Foreign Science and Technology Center, Charlottesville, Va.

MEASUREMENT OF GAIN CO2 TRANSITIONS 00(0)1-10(0)0 AND 00(0)1-20(0)0 [IZMERENIE KOEFFITSIENTOV YSILENIYA NA PEREKHODAKH 00(0)1-10(0)0 I 00(0)1-20(0)0 CO2]

I. K. Babayev et al 16 Oct. 1970 11 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskopii, Akad. Nauk Belorussk. SSR (Minsk), v. 9, no. 4, 1968 p 610-613

(AD-720729; FSTC-HT-23-099-70) Avail: NTIS CSCL 20/5

The present work pertains to the radioscopic measurement

of the gain in flow type system with CO2, air and He in single, binary and tertiary mixtures. The addition of air to CO2 and to a mixture of CO2 and helium does not result in a substantial increase in gain, while the addition of helium to pure CO2 and to CO2 + air substantially increases gain. Author (GRA)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N71-25616# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain). Dept. de Materiales.
STUDY ON THE OUTGASSING OF MATERIALS
Jun. 1970 10 p
(Contract ESTEC-582/68-SL)
(Rept-710-229/70; Rept-6) Avail: NTIS

The progress is described in the study of outgassing of sample materials, e.g. aluminum foils and coaxial cables using infrared analysis. ESRO

N71-25626# Naval Research Lab., Washington, D.C.
KINETICS OF THE CHLORIDE-INDUCED OXIDATION OF IRON AT 300 C Interim Report
M. A. Scheiman 8 Feb. 1971 23 p refs
(AD-719887; NRL-7204) Avail: NTIS CSCL 11/6

Iron was oxidized in the absence of oxygen at 300C in solutions containing chloride and/or iron(II) ions. The oxidation reaction was conveniently studied by the hydrogen-effusion method, which determines the rate at which hydrogen is evolved. The generally accepted concept that chloride ions accelerate the oxidation of iron has not received experimental verification, because, in addition to chloride ions, the system must contain iron(II) ions. An empirical equation has been derived that describes the extent of iron oxidation W with time t as a function of the iron(II) chloride molar concentrations. Magnetite, or Fe3O4, is deposited as a tightly adhered crystalline film at the metal/solution interface and apparently also quenches the reaction rate by serving as a physical barrier. The differential with respect to time of a term of the equation describes a rate mechanism that is proceeding under the diffusive control of ions migrating across the Nernst boundary layers of anodic and cathodic regions of an oxide-free metal/solution interface. Author (GRA)

N71-25632# National Bureau of Standards, Washington, D.C. Metallurgy Div.
ON THE DIFFUSION SOLDERING OF TITANIUM [O DIFFUZIONNOI PAIKE TITANA]
A. Y. Shinyaev et al 1970 11 p refs Transl. into ENGLISH from Tr. Inst. Met. Akad. Nauk SSSR (Moscow), 1965 p 305–308 Supported by NSF
(DMDC-5767; TT-70-58076) Avail: NTIS CSCL 11F

The results of investigating the structure of diffusion zones, which occur during the welding of titanium are presented. Diffusion soldering results in the mutual diffusion of contacting metals. In the diffusion zone a liquid layer is formed which acts as a solder. During hardening, the liquid unites the alloying surfaces. Author (GRA)

N71-25639# WADCO Corp., Richland, Wash.
EFFECT OF COLD WORK ON IRRADIATION INDUCED SWELLING
J. J. Holmes and J. L. Straalsund Jul. 1970 15 p ref Presented at the meeting of the Am. Nucl. Soc., Washington, D.C.
(Contract AT(45-1)-2170)
(WHAN-SA-9; CONF-701102-11) Avail: NTIS

The effects of cold work on irradiation-induced density changes in AISI types 316 and 304 stainless steel and Nickel 200 were investigated after irradiation to a peak fluence of 3 × 10 to the 22nd power n/sq cm (E > .1 MeV) at calculated temperatures ranging from 700 to 1400 F. Over the whole range or irradiation temperatures investigated, no swelling was found in the 75% cold worked material. Swelling was also suppressed in the 25% cold worked material except for one irradiation temperature, 900 F, where the density decrease was found to be .08% compared to .26% for the annealed material. Cold work was not as effective in suppressing swelling in the AISI type 304 compared to the 316 stainless steel, for which cold work essentially eliminates swelling. Cold work was also found to be effective in reducing swelling in Nickel 200. For irradiation temperatures below 1000 F, 50% cold work reduced the swelling in annealed Nickel 200 by about 50%. However, for irradiation temperatures of 1100 F and above, no benefits were obtained. Author (NSA)

N71-25640# Oak Ridge National Lab., Tenn.
INFLUENCE OF TITANIUM, ZIRCONIUM, AND HAFNIUM ADDITIONS ON THE RESISTANCE OF MODIFIED HASTELLOY N TO IRRADIATION DAMAGE AT HIGH TEMPERATURE, PHASE 1
H. E. McCoy, Jr. Jan. 1971 17 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3064) Avail: NTIS

The influence of small additions to Ti, Zr, and Hf on the mechanical properties of a modified Hastelloy N with the nominal composition Ni-12% Mo-7% Cr-0.2% Mn-0.05% C is described. It deals specifically with test results from numerous, small, laboratory melts and several 100-lb melts from commercial vendors. Additions of Ti, Zr, and Hf had beneficial effects on the properties of the alloy both unirradiated and after irradiation. Irradiation temperature had a marked effect upon the properties of all alloys investigated. Generally, good properties were observed when the irradiation temperature was 650 C or less and poor when the temperature was 700 C or higher. This large effect of irradiation temperature was attributed to coarsening of the carbide structure at the higher temperature. Author (NSA)

N71-25641# WADCO Corp., Richland, Wash.
IRRADIATION-INDUCED CREEP IN AUSTENITIC STAINLESS STEL
E. R. Gilbert and L. D. Blackburn Oct. 1970 19 p refs Presented at the 2d Intern. Conf. on the Strength of Metals and Alloys, Pacific Grove, Calif., 30 Aug.–4 Sep. 1970 Submitted for publication
(Contract AT(45-1)-2170)
(WHAN-FR-30; CONF-700819-10) Avail: NTIS

Data obtained at 43 and 370 C on irradiation-induced creep in annealed austenitic stainless steels 304, 316, and EN58B were correlated in terms of a linear stress dependence, a decreasing creep rate with increasing temperature, an average neutron energy and flux, and the state of stress. The state-of-stress correlation implies that irradiation-induced creep is partly due to volume increase and to shape change. Author (NSA)

N71-25642# National Science Foundation, Washington, D.C.
AN INVESTIGATION OF THE MAGNETOSTRICTION OF THE PARAPROCESS IN ORDERED IRON ALLOYS [ISSLEDOVANIE MAGNETOSTRIKTSII PARAPROTSESSA V UPORYADOCHIVAYUSHIKHSYA SPLAVAKH ZHELEZA]
I. Ya Dekhtyar et al 1970 12 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 8, 1963 p 315–320 Prepared in part by NBS

(TT-70-59069; DMDC-5700) Avail: NTIS CSCL 11F

A study was made of the magnetostriction of the paraprocess in ordered alloys of Fe with 50 atomic percent Co and of Fe with 30 atomic percent Pt with different degrees of order, on the basis of the experimental results, calculations were carried out of the values of the relative change in the average atomic magnetic moment with pressure, and of the relative change in the average exchange integral with pressure. Author (GRA)

N71-25643# National Science Foundation, Washington, D.C.
KINETICS OF THE REACTION OF HYDROGEN AND NITROGEN IN IRON AND STEEL
S. I. Popel et al 1970 14 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chernaya Met. (Moscow), v. 10, no. 2, 1967 p 10 Prepared in part by NBS
(TT-70-58193; DMDC-6045) Avail: NTIS CSCL 11F

Hydrogen and nitrogen are withdrawn from steel by transfer in CO bubbles or in neutral gas and even by extracting from blisters or from the plane surface by vacuums. In all these different situations, gas transmissions toward the surface are different. Some researchers think that the hydrogen degassing speed is limited by its diffusion in steel while others draw their arguments from the use of kinetic rules. The study reported was aimed at finding that element which limits the process speed, by comparison with the intensity of hydrogen transmission and with nitrogen with an artificial degassing speed. Author (GRA)

N71-25644# California Univ., Los Angeles. School of Engineering and Applied Science.
EXFOLIATION AND THE MECHANICAL BEHAVIOR OF SCALES
D. L. Douglass Feb. 1971 35 p refs Presented at the ASM Seminar, Oxidation of Metals and Alloys, Cleveland, 17–18 Oct. 1970
(Contract N00014-67-A-0111-0023)
(AD-719910; UCLA-ENG-7105) Avail: NTIS CSCL 11/6

Strains exist in oxide films due to volume mismatch, adherency, epitaxy, etc. and often cause stresses that exceed the fracture stress of the scale. Fracture may lead to exfoliation which then exposes fresh metal and enhances the oxidation process. Even if strain-free scales form during isothermal oxidation, subsequent cooling and reheating may create strains due to differential thermal dilation of the oxide and metal. Strains may be relieved by plastic deformation of either the scale or the substrate, although in many cases the scales are not plastic. The mechanical properties and behavior of scales determine primarily if they remain intact and provide their intended protection. All of the factors involved in film fracture and exfoliation, including both short-time and time-dependent deformation, are considered with respect to film spalling. Author (GRA)

N71-25645*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CYCLIC CREEP RUPTURE BEHAVIOR OF THREE HIGH TEMPERATURE ALLOYS
Gary R. Halford Washington May 1971 26 p refs
(NASA-TN-D-6309; E-6062) Avail: NTIS CSCL 11F

A series of cyclic creep rupture tests were conducted on three high high-temperature alloys, titanium-6Al-2Sn-4Zr-2Mo, the cobalt-base alloy L-605, and 316 stainless steel, over a range of operating conditions. The results substantiate previous assumptions that the cyclic creep rupture curve is indeed independent of the total strain range and the level of compressive stress employed. The cyclic creep rupture curve therefore represents a unique relation between tensile stress and tensile time-to-rupture for strain-limited cyclic loading. The cyclic creep rupture curves were found to lie above and to the right of the conventional (constant load) monotonic curves by factors ranging from 2 to 20 in rupture time. Cyclic creep acceleration and differences between tensile and compressive creep rates were also observed. Author

N71-25647# National Bureau of Standards, Washington, D.C. Metallurgy Div.
STRUCTURE AND PHASES FORMED BY INTERDIFFUSION OF Al AND Fe
K. I. Vashchenko et al 1970 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), no. 4, 1966 Supported by NSF
(DMDL-6043; TT-70-58191) Avail: NTIS CSCL 11F

The structure and phase composition of the diffusion layer of Armco-iron (0.04%C) and steel at different temperatures are studied along with and their behavior in the fusion of pure aluminum or in the aluminum alloy containing 4% Silicon and 7% zinc. Author (GRA)

N71-25648# National Science Foundation, Washington, D.C.
EFFECT OF MANGANESE ON THE SELF DIFFUSION OF IRON [VLIYANIE MARGANTSANA SAMODIFFUZIYU ZHELEZA]
P. L. Gruzin 1970 14 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 99, no. 2, 1954 p 247–250 Prepared in part by NBS
(TT-70-57056; DMDC-2923) Avail: NTIS CSCL 11F

The temperature dependence of the self-diffusion coefficients of iron in gamma-phase of iron-managnese alloys was studied by the method of radioactive indicators, using artifically-radioactive isotope of iron, Fe-59. The self-diffusion coefficients were calculated according to the given measurements of the integral radioactivity of the specimen which successively removed the layers with it. The specimens of the alloys were prepared in the form of lamellae measuring approximately 5 × 8 × 25 mm. A thin layer of the radioactive isotope of iron was deposited electrolytically on one of the surface of the specimen. The specimens were then joined in pairs from their active sides, fastened with clamps, and placed in a quartz tube. Author (GRA)

N71-25649# Washington Univ., Seattle. Coll. of Engineering.
A STUDY OF PHASE TRANSFORMATIONS AND SUPERCONDUCTIVITY Annual Progress Report
Douglas H. Polonis 15 Oct. 1970 45 p refs
(Contract AT(45-1)-2225-T-13)
(RLO-2225-T-13-6) Avail: NTIS

Studies in the program have concentrated on the general problem of beta phase decomposition in alloys based on titanium and zirconium. Special emphasis has been placed on the effects of plastic deformation on the metastable beta phase and on the formation and reversion of the omega phase. A martensitic phase is induced by such plastic strain, and there are indications that the formation of the omega phase during subsequent aging is inhibited by this deformation induced transformation. Superconductivity measurements have proven to be very discriminating in the detection of minor perturbations in the structure and composition of beta stabilized alloys. It has been possible to detect phase separation processes and the initial stages of transformation to the omega phase before they are unambiguously discernible by any other available technique. An important development arising from these studies has been the establishment, by means of superconductivity measurements, that a phase separation reaction characterizes the decomposition of the metastable beta phase in several isomorphous and eutectoid-type alloy systems. Author (NSA)

N71-25650# National Science Foundation, Washington, D.C.
ON THE DETERMINATION OF THE PERMEATION OF GASES THROUGH METALS [IZMERENIE GLUBINY PRONIKNOVENIYA I KOEFFICIENTS DIFFUZII GAZA V METALLE]

A. M. Rodin 1970 7 p refs Transl. into ENGLISH from Pribory i Tekhn. Eksperim. (Moscow), no. 4, 1957 p 68–69 Prepared in part by NBS
(TT-70-59120; DMDC-5899) Avail: NTIS CSCL 11F

It is shown that the kinetics of gas separation of a metallic plate whose surface layer is saturated by gas allows the evaluation of the penetration depth and a determination of the diffusion coefficient of the given gas in metal provided that gas separation is measured separately from both sides of the plate. Author (GRA)

N71-25659# National Science Foundation, Washington, D.C.
STUDY OF MUTUAL DIFFUSION IN CU-AU SYSTEM [ISSLEDOVANIE VZAIMNOI DIFFUZII SISTEME CU-AU]
I. B. Borovskii 1970 17 p refs Transl. into ENGLISH from Tr. Akad. Nauk SSSR, Inst. Met. (Moscow), no. 15, 1963 p 32–40 Prepared in part by NBS
(TT-70-59113; DMDC-5847) Avail: NTIS CSCL 11F

The system Cu-Au forms continuous solid solution series which, at temperatures 425 and 395 C, are dissociated by releasing ordered phases of Cu-Au and Cu3Au. Experimental studies on mutual diffusion were carried out for the systems, which give rise to continuous solid solution series, and investigations were made for the systems that form intermetallic compounds (reaction diffusion). It is established that in the systems of the first type, the diffusion layer is characterised by continuous variation in composition. In the second type, layers of intermetallic compounds are formed which are in accordance with the diagram of their state. A conclusion is that the main factor determining the composition and order of layer growth in diffusion, is the diagram of state for the given system. Author (GRA)

N71-25660# National Science Foundation, Washington, D.C.
MEASUREMENT OF THE DIFFUSION COEFFICIENT IN STEEL AND Fe ALLOYS [OPREDELENIE KOEFFISIENTOV DIFFUZII V SPLOVAKH ZHELEZA]
M. E. Blanter 1970 28 p refs Transl. into ENGLISH from Zavodsk. Lab. (Moscow), v. 14, 1948 p 296–306 Prepared in part by NBS
(TT-70-59099; DMDC-5805) Avail: NTIS CSCL 11F

Results of the processes, during heating and cooling (formation and disintegration of austenite) during tempering of the hardened steel (formation of carbide and their coagulation) and its chemico-thermal treatment, are dependent upon the intensity of the course of diffusion. This intensity is determined by the limits of concentrating conditions and the value of diffusion constants. Determination of diffusion constants, mainly the coefficients of diffusion, are distinguished by considerable experimental complications. The work covers the study of surface saturation in the process of chemico-thermal treatment. However, at this stage, the concentration of a diffusing element in the surface layer, with some time of duration, increases under a complicated law. The usually employed solutions of Fick's differential equation were obtained while supposing the constancy of concentration in the preliminary plane. Author (GRA)

N71-25661# National Science Foundation, Washington, D.C.
DETERMINATION OF THE PARAMETERS OF VOLUME AND GRAIN BOUNDARY DIFFUSION OF SILVER INTO ALUMINUM [VIZNACHENNYA PARAMETRIV OBEMNOI TA GRANICHNOI DIFUZII SCRIBLA V ALYUMINII]
S. D. Gertzriken et al 1970 8 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 4, no. 1, 1959 p 127–129 Prepared in part by NBS
(TT-70-57045; DMDC-2714) Avail: NTIS CSCL 11F

The diffusion of silver into aluminum (mono-and poly-crystalline) in the temperature range of 220-620C is discussed. Polycrystalline specimens consisted of grains of 15 microns, obtained by about 80% deformation caused by further recrystallization annealing at 350C for seven hours. Radioactive silver was deposited electrolytically on the polished surface of the specimen, from which the oxide film was removed periodically by a weak solution of hydrofluoric acid. Diffusion annealing was carried out in argon atmosphere in electric furnaces. The depthwise distribution of active silver in the specimen, after diffusion annealing, was determined by mechanically removing the layers and by measuring the integral activity. In case of volume diffusion, the depth of the diffusion layer was 200-300 for 5-20 hrs of annealing at 450-620C. Author (GRA)

N71-25662# National Science Foundation, Washington, D.C.
ON THE MOBILITY OF ATOMS IN A MOLYBDENUM TUNGSTEN ALLOY [PRO RUKHLIVIST ATOMIV U SPLAVI MOLIBDEN VOLFRAM]
D. F. Kalinovich 1970 9 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 10, no. 12, 1965 p 1365–1367 Prepared in part by NBS
(TT-70-57052; DMDC-2915) Avail: NTIS CSCL 11F

The diffusion of radioactive tungsten and radioactive molybdenum in a molybdenum-35 atomic percent tungsten alloy was studied over a temperature range of 1500 to 2400C. The value of D sub 0 for W was found to be 6.9 sq cm/sec and Q was 85,000 cal/mol. For Mo, the value of D sub 0 was 28 sq cm/sec and Q = 92kcal. Author (GRA)

N71-25666# National Bureau of Standards, Washington, D.C. Metallurgy Div.
THE MUTUAL DIFFUSION OF TITANIUM WITH COPPER AND OTHER METALS AS APPLICABLE TO THE SOLDERED COMPOUNDS [IZUCHENIE VZAIMNOI DIFFUZII TITANA S MED YU I DRUGIMI METALLAMI]
A. Ya. Shinyaev et al 1970 14 p refs Transl. into ENGLISH from Tr. Inst. Met., Akad. Nauk SSSR (Moscow), 1964 p 289–293 Sponsored by NSF
(DMDC-5785; TT-70-59084) Avail: NTIS CSCL 11F

It was established that the strength of soldered compounds of titanium products is determined by the phase structure of the diffusion layer, formed in the processes of soldering, between titanium and a protective galvanic coating. It was shown that in the diffusion zone, nuclei of second phase may be formed which strengthen the soldered compound provided they are small and are not mutually overlapped. To determine the service period of soldered compounds, functioning at higher temperatures, the kinetic process of mutual diffusion between titanium and galvanic coatings at ordinary operation temperatures was investigated. Experiments were carried out on the mutual diffusion between titanium and other metals serving as galvanic coatings, in the interval of temperatures from 200 to 900 C. Author (GRA)

N71-25667# National Bureau of Standards, Washington, D.C. Metallurgy Div.
THE INTERRELATIONSHIP BETWEEN SHORT RANGE AND LONG RANGE ORDER AND THE PROPERTIES OF ALLOYS [VZAIMOSUYAZ' BLIZHNENGO I DALNEGO PORYADKOV I SVOISTVA SPLAVOV]
I. L. Aptekar 1970 17 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 8, 1963 p 1970–1975 Supported by NSF
(DMDC-5775; TT-70-59079) Avail: NTIS CSCL 11F

The process of ordering is considered in an alloy of the beta-brass type on the basis of a quasichemical approximation, where independent parameters of long-range and short-range orders and the corresponding energetic parameters are introduced. It is shown that in the general case the form of the curves of the dependence of the order parameters on the temperature, the form of the concentration curves of Kurnakov's points and the physical properties of the alloys are functions of the parameters. Author (GRA)

N71-25668# National Bureau of Standards, Washington, D.C. Metallurgy Div.

ON SOME PECULARITIES OF MAGNESIUM DISTRIBUTION IN HIGH STRENGTH CAST IRON [O NEKOTORYKH OSOBENNOSTYAKH RASPREDELENIYA MAGNIYA V VYSOKOPROCHNOM CHUNGUNE]

I. L. Mirkin et al 1970 21 p refs Transl. into ENGLISH from Liteinoe Proizv. (Moscow), no. 12, 1957 p 13–16 Supported by NSF

(DMDC-5783; TT-70-59085) Avail: NTIS CSCL 11F

Spectral analysis was used to investigate magnesium alloy cast iron containing globular graphite. The microhardness of the alloys as well as the microstructure of the alloys was investigated. Regions of high magnesium concentrations in the microstructure were studied. GRA

N71-25675# National Bureau of Standards, Washington, D.C. Metallurgy Div.

THEORY OF DIFFUSION IN ORDERED ALLOYS OF THE Au-Cu TYPE [TEORIYA DIFFUZII V UPORYADOCHIVAYUSHIKHSYA SPLAVAKH Au-Cu]

Z. A. Matysina 1970 12 p refs Transl. into ENGLISH from Ukr. Fiz. Zhur. (Kiev), no. 8, 1963 p 190–195 Supported by NSF

(DMDC-5786; TT-70-59086) Avail: NTIS CSCL 11F

Interdiffusion was investigated in ordered alloys with a crystal lattice of the Cu3-Au and CuAu type. The interdiffusion coefficient was found to undergo an abrupt change on transition from order to disorder. A numerical calculation shows that on passing from the unordered to the ordered state the interdiffusion coefficient of Cu3Au and CuAu alloys may increase several times. The theoretical data obtained agree with the experimental data on the investigation of diffusion in Cu-Au type alloys. Author (GRA)

N71-25677# National Bureau of Standards, Washington, D.C. Metallurgy Div.

THE CHROMIZATION OF FERRO-CHROME ALLOYS AT HIGH TEMPERATURES

R. P. Krentsis et al 1970 14 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), no. 12, 1960 Sponsored by NSF

(DMDC-6048; TT-70-58195) Avail: NTIS CSCL 11F

Temperature behavior during the changing of the enthalphy (N, cal/g), of chromium and of some alloys containing chromium from room temperature to temperatures near that of fusion was studied. Models of aluminothermic chromium, carbonless ferrochromium and nitrogenless ferrochromium and chrome-aluminum were tested from 1000 to 12000 C with the aid of a heterogeneous mixture and at still higher temperatures with a vacuum mixture. Fallacy rate at temperatures higher than 1300 C was about 1.2% and at lower temperatures nearly 0.8%. Additional experiments using a refrigerater gave measurement results Delta N (t)sub o, attenuated polyterms were laid out, and empirical polynomials which describe the dependence of the temperature and of the change of the enthalpy were calculated. (GRA)

N71-25678# George Washington Univ., Washington, D.C. Inst. for the Study of Fatigue Fracture and Structural Reliability.

APPLICATION OF THE SEM TO STUDY OF MECHANISMS OF METAL FATIGUE

Douglas E. MacDonald and William A. Wood Jan. 1971 22 p refs

(Contract N00014-67-A-0214-0011)

(AD-719927; TR-5) Avail: NTIS CSCL 11/6

The scanning electron microscopy (SEM), already much used in fractography of crack surfaces exposed after full fracture by fatigue, seems in addition eminently suited for studying the microstructural changes preceding fracture. Such changes are illustrated here by work on titanium fatigued by alternating torsion. The observations show, for example, that the extrusion of material from slip zones where deformation concentrates changes from a ribbon mode to a point mode as the strain amplitude decreases from the elastic to the plastic range. They show, too, that, contrary to some current theories, the next stage of fatigue, the formation and growth of fine shear cracks, is not necessarily an extension of the preceding slip-zone activities; more often it occurs independently. Finally, they show that the final stage, formation and growth of a tensile crack responsible for final failure, can hardly be treated, as often it is, as a crack in a quasi-continuous medium; it behaves rather as one growing in a medium already suffused by fine cracks. Author (GRA)

N71-25681# National Science Foundation, Washington, D.C.

DIFFUSION OF CARBON IN TITANIUM [DOSLIDZHENNYA DIFUZII VUGLETSYU V TITANI]

I. I. Kovenskii 1970 7 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 8, no. 7, 1963 p 797–798 Prepared in part by NBS

(TT-70-57049; DMDC-2894) Avail: NTIS CSCL 11F

The diffusion of carbon in its solid solution using titanium as the base and with 0.1% weight concentration of carbon, was studied. At the temperatures of annealing employed (1223-1923K), diffusion took place in the beta phase. The samples used were segments of wire having a diameter 0.5 mm and length approximately 70mm. A zone of approximately 10mm length was made in the central part of the sample which contained radioactive isotope of carbon C-14. By means of surface counters the distribution of radioactivity along the sample was measured and graphs of the distribution of radioactivity were drawn from the data obtained by these measurements (coordinate of any point of the sample was measured from its distance from the edge). Author (GRA)

N71-25682# National Science Foundation, Washington, D.C.

GROWTH OF PORES DURING PLASTIC DEFORMATION [O POROOBRAZOVANII PRI PLASTICHESKOI DEFORMATSII]

A. Ya. Shinyaev 1970 8 p refs Transl. into ENGLISH from Issled. po Zharoproch. Splavam, Akad. Nauk SSSR, Inst. Met. (Moscow), no. 10, 1963 p 42–44 Prepared in part by NBS

(TT-70-59063; DMDC-5676) Avail: NTIS CSCL 11F

Several processes that take place in metals and alloys are followed by the development of pores. Mutual diffusion of two components is particularly related to such processes when the diffusion coefficients of these components are different. Theoretical research on mutual diffusion enabled the determination of the position of pore developing locations from the demarcation plane. The effect of plastic deformation on the process of growth of pores was studied in mutual diffusion of two components. Nickel-Titanium and Copper-Titanium were selected as a diffusion pair. Diffusion heating was conducted so that a different degree of specimen compression was employed. Author (GRA)

N71-25687# National Bureau of Standards, Washington, D.C. Metallurgy Div.

ON THE INTERDIFFUSION OF TITANIUM WITH VARIOUS ELEMENTS [O VZAIMNOI DIFFUZII TITANA S RAZLICHNYMI ELEMENTAMI]

A. Ya. Shinyaev et al 1970 16 p refs Transl. into ENGLISH from the publ. 'Vsesoyunaya Nauchnaya Konferentsiya po Diffuzii v Metallakh i Splavakh, Kiev' 1964 p 51–59 Sponsored by NSE

(DMDC-5804; TT-70-59098) Avail: NTIS CSCL 11F

Results of the investigations on interdiffusion of titanium with the elements which form continuous series of solid solutions, for instance molybdenum, and also with elements having limited solubility in titanium-with nickel, copper, rhodium tungsten are

presented. The problems of determining the coefficients of interdiffusion were studied by Matano's graphical method as well as by analytical method of Holl. While carrying out investigations interdiffusion the concentration of components in diffusion zone was measured on the attenuation of a narrow beam of gamma-radiation.
Author (GRA)

N71-25688*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRON AND ION MICROPROBES APPLIED TO CHARACTERIZE AN ALUMINIDE COATING ON IN-100
Robert M. Caves and Salvatore J. Grisaffe Washington May 1971 33 p refs
(NASA-TN-D-6317; E-5829) Avail: NTIS CSCL 11F

Exploratory analytical studies were performed on an experimental aluminide coating on the nickel alloy IN-100. The analyses included X-ray diffraction, electron beam microprobe, and an ion beam mass spectrometer probe; these analyses were supplemented by limited X-ray fluorescence and metallography. An evaluation of the analytical approaches was made with regard to their ability to characterize coatings for the high temperature oxidation protection of materials. Only qualitative information could be assigned for the approaches separately and/or collectively. Quantitative characterization of such a complex materials system was not achieved with the existing state-of-the-art analytical approaches employed.
Author

N71-25692# National Bureau of Standards, Washington, D.C. Metallurgy Div.
CHANGES IN ELASTICITY, MAGNETOSTRICTION, AND ELECTRIC RESISTANCE OF IRON-ALUMINUM ALLOYS DURING ORDERING [IZMENENIYA UPRUGOSTI, MAGNITOSTRIKTSI I ELEKTROSOPORTIVLENIYA ZHELEZO-ALUMINIEVYKH SPLAVOV PRI UPORYADOCHENII]
V. L. Sandomirskaya et al 1970 12 p refs Trans. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 8, 1963 p 284–288 Sponsored by NSF
(DMDC-5793; TT-70-59089) Avail: NTIS CSCL 11F

It is shown that in alloys containing from 8 to 16 percent by weight of Al, the change in electric resistance and magnetostriction is the usual one for ordering alloys, which the change in the modulus of elasticity is of an anomalous nature as compared with the behavior of other known ordered alloys during similar thermal treatment.
Author (GRA)

N71-25693# National Bureau of Standards, Washington, D.C. Metallurgy Div.
STUDY OF THE TEMPERATURE DEPENDENCE OF THE COEFFICIENT OF SELF DIFFUSION OF IRON IN STEEL [ISSLEDOVANIE TEMPERATURNOI ZAVISMOSTI KOEFFITSIENTA DIFFUZII ZHELEZA V STALI]
P. L. Gruzin et al 1970 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), no. 1, 1970 p 167070–167074 Supported by NSF
(DMDC-5795; TT-70-59091) Avail: NTIS CSCL 11F

The diffusion coefficient of Fe, Cr and Co in Fe (Iron-armco and Steel with 0.8% of C) is subjected to exponential dependence in the interval of temperature from 1100-1250C and it deviates from this dependence below the 1100C temperature interval. The detected deviation, from the exponential dependence, is the result of different structural condition of austenite under high and low temperatures. It was to study in more details the effect of the size of austenite grain on the coefficient of self-diffusion for iron under various temperatures. As an object of this investigation steel-Y7 (with 0.73% of C) was selected, because when carbon content is nearer to the eutectic mixture, then we can study self-diffusion of iron in gamma-state under the lowest temperature.
Author (GRA)

N71-25695# National Bureau of Standards, Washington, D.C. Metallurgy Div.
DIFFUSION IN TWO PHASE ALLOYS [DIFFUZIYA V DVUKHFAZNYKH SPLAVAX]
A. Ya. Shinyaev et al 1970 14 p refs Transl. into ENGLISH from the publ. 'Podvizhnost Atomov' Kiev, Akad. Nauk Ukr. SSR, 1964 p 88–95 Supported by NSF
(DMDC-5800; TT-70-59096) Avail: NTIS CSCL 11F

Certain results were made while studying the diffusion process in a two-phase system on the basis of concrete models. The diffusion processes was analysed on the basis of independent flows of the diffusion substance. Predetermined with certain values of diffusion coefficients in phases, and by applying the method of geometrical constructions found there an expression which connects the values of effective diffusion coefficient D sub ef with the diffusion coefficients in each phase D sub 1 and D sub 2.
Author (GRA)

N71-25700# National Bureau of Standards, Washington, D.C. Metallurgy Div.
STUDY OF THE DIFFUSION COEFFICIENT IN METALS BY MEANS OF EVAPORATION [METOD IZUCHENIYA KEOFFITSIENTA DIFFUZII METALLOV PUTEM ISPARENIYA]
V. Bugakov et al 1970 13 p refs Transl. into ENGLISH from Zh. Tekhn. Fiz. (Leningrad), v. 4, 1934 p 1342–1346 Supported by NSF
(DMDC-5757; TT-70-59073) Avail: NTIS CSCL 11F

A new method was recommended for the determination of diffusion coefficient in metals. By the described method, diffusion coefficients of zinc in brass were determined in the interval of temperature ranging from 700 to 950 C which obtained a temperature involved dependence for the diffusion coefficient for zinc in brass which has an exponential character was obtained. The coefficient b was determined in the formula D sub T = Ae to the 3b squared power T sub s/T, henceforth, it was found that the value, b lies within the interval of the most frequent values found.
Author (GRA)

N71-25816# National Science Foundation, Washington, D.C.
INFLUENCE OF THE INTERGRANULAR STRUCTURE OF AUSTENITE ON SELF DIFFUSION OF IRON [VLIYANIE VNUTRIZERENNOI STRUKTURY AUSTENITA NA SAMODIFFUZIYU ZHELEZA]
P. L. Gruzin et al 1970 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 93, no. 6, 1953 p 1021–1023 Prepared in part by NBS
(TT-70-57068; DMDC-4314) Avail: NTIS CSCL 11F

The transformation of austenite into martensite taking place after the preliminary stabilizing annealing at 1300 and cooling down to room temperature, and also the retransformation of martensite into austenite at 500–700 during heating of specimens bring about significant changes in the internal structure of austenite grains. The changes give rise to a decrease in dimensions of the crystalline lattice of austenite.
Author (GRA)

N71-25817*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APPLICATION OF REGRESSION ANALYSIS TECHNIQUES TO REFRACTORY COATING MEASUREMENT EXPERIMENTS
Bobby G. Junkin 27 Apr. 1971 41 p refs
(NASA-TM-X-64594) Avail: NTIS CSCL 11F

A procedure is described for conducting a statistical analysis of data obtained from two nondestructive techniques/instruments used to measure the thickness of protective refractory coatings on niobium alloy. A regression analysis is performed on instrument output data to determine the significance of linear, quadratic, and cubic models. It is concluded that the linear regressions are the

best choice of models for the particular coating, instrument, and base metals used. Author

N71-25818# Bureau of Mines, Rolla, Mo.
DISSOCIATION AND VAPORIZATION OF GOLD CHLORIDES AND GOLD BROMIDES
Aarne Visnapuu, Barbara C. Marek, and James W. Jensen May 1971 25 p refs
(BM-RI-7513) Avail: Issuing Activity

Dissociation and vaporization of gold chlorides and bromides were investigated by a static pressure method and by Knudsen cell mass spectrometer. Two distinct chlorine and three distinct bromine pressure-temperature relationships were observed for the respective salts. The chlorine pressures are attributed to the dissociation of Au_2Cl_6 and Au_2Cl_2, and the bromine pressures to the dissociation of Au_2Br_6, Au_2Br_4, and Au_2Br_2. These pressure-temperature relationships were used to calculate dissociation pressure equations, enthalpies, and entropies of dissociation for each salt. Mass analysis of the vapors over Au_2Cl_6 between 83 deg and 152 deg C confirmed the existence of gaseous Au_2Cl_6. Ionization potential of this molecule is 11.0 + or − 0.1 ev and enthalpy of vaporization is 28.1 + or − 2.0 kcal/mole. Mass analysis of the vapors over the gold bromides detected only Br_2 in the temperature range 15−150 C. Author

N71-25819# National Science Foundation, Washington, D.C.
INFLUENCE OF OXYGEN PRESSURE ON THE KINETICS OF HIGH TEMPERATURE OXIDATION OF TITANIUM [VLIYANIE DAVLENIYA KISLORODA NA KINETIKU VYSOKOTEMPERATURNOGO OKISLENIYA TITANA]
V. I. Dyachkov et al 1970 10 p refs Transl. into ENGLISH from Vestn. Leningr. Univ., Ser. Fiz. i Khim. (Leningrad), v. 23, no. 4, 1968 p 158−150 Prepared in part by NBS
(TT-70-57065; DMDC-4017) Avail: NTIS CSCL 11F

The influence of oxygen pressure on the nature of the relationship as well as the kinetic parameters of the general process of oxidation of titanium and growth of an oxygen diffusion layer in it were studied. GRA

N71-25820# National Science Foundation, Washington, D.C.
INVESTIGATION OF THE EFFECT OF SMALL ADDITIONS OF TIN AND ANTIMONY ON THE PARAMETERS OF VOLUME AND GRAIN BOUNDARY DIFFUSION OF THESE ELEMENTS INTO COPPER [DOSLIDZHENNYAVPLIVU MALIKH DOMISHOK OLOVA I SURMI NA PARAMETRI OBEMNOI I GRANICHNOI DIFUZII TSIKH DOMISHOK UMID]
S. D. Hertzricken et al 1970 17 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 6, 1961 p 398−407 Prepared in part by NBS
(TT-70-57066; DMDC-5561) Avail: NTIS CSCL 11F

The radioactive isotopes of tin (Sn^{113}, Sm^{123}) and antimony (Sb^{124}) are used for studying the volume and grain boundary diffusion of these elements into pure copper and copper with their small admixtures within a temperature range of 300−900C. Volume diffusion was studied on monocrystalline copper and the alloy specimens of average grain size (0.5mm). Specimens of small grain size (20−40 microns) were used for studying grain boundary diffusion. Grains of required sizes were obtained by recrystallization. The controlled experiments showed that the grain size practically did not change during diffusion annealing. The specimens taken for the study of volume and grain-boundary diffusion had parallelopiped form of 10 × 15 × 2-3 mm size with sides polished carefully. Author (GRA)

N71-25821# National Science Foundation, Washington, D.C.
EFFECT OF CARBON ON SELF DIFFUSION OF IRON IN THE IRON-NICKEL SYSTEM [VLIYANIE UGLERODA NA SAMODIFFUZIYU ZHELEZA V SISTEME ZHELEZO NIKEL]
P. L. Gruzin et al 1970 12 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 93, no. 5, 1953 p 809−812 Prepared in part by NBS
(TT-70-57055; DMDC-2922) Avail: NTIS CSCL 11F

The effect of carbon on the self-diffusion of iron in austenite has been studied and it has been found that as the carbon content in iron increases, the bonding of atoms in the crystalline austenite lattice diminishes. The effect of carbon on self-diffusion in the iron-nickel binary system is also observed. When nickel content is 25−30%, the iron-nickel alloys retain their austenite structure right up to room temperature. On adding carbon to the alloys, the martensite transformation temperature is considerably reduced. Author (GRA)

N71-25822*# Translation Consultants, Ltd., Arlington, Va.
SHORT TERM CREEP OF METALS AND ALLOYS UNDER CONDITIONS OF AERODYNAMIC HEATING [KRATKOVREMENNAYA POLZUCHEST METALLOV I SPLAVOV V USLOVIYAKH AERODINAMICHESKOGO MAGREVA]
I. N. Bogachev et al Washington NASA May 1971 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), no. 4, 1970 p 142−147
(Contract NASw-2038)
(NASA-TT-F-13633) Avail: NTIS CSCL 11F

A method of testing metals and alloys for short-term creep under conditions of aerodynamic heating (in dynamic contact with high velocity air flows in the test apparatus) is described. Tests on Ni, Co, Armco Fe, Ti alloys, and various types of C and alloy steel at 500−1000 C show that the nature of the creep process under aerodynamic conditions differ sharply from that characterizing static creep. The change is attributed to thermal, erosive, and corrosive effects, and in some cases to the alternating stresses arising from high-speed air flows. Author

N71-25831 Cornell Univ., Ithaca, N.Y.
THE DIFFUSION OF CARBON 14 IN TUNGSTEN AND TUNGSTEN RHENIUM ALLOYS
Adam Shepela (Ph.D. Thesis) 1970 274 p
Avail: Univ. Microfilms Order No. 70-12649

The diffusion coefficients of the radioactive tracer carbon-14 in randomly oriented crystals of tungsten and tungsten-rhenium alloys were measured over the temperature range 1500 to 1800 C. The values for the activation energy (cal/mole) and frequency factor (sq cm/sec) for carbon-14 in tungsten agree well with the values determined by Kovenskii (1800 - 2800 C). In all diffusion samples a zone of carbon depletion adjacent to the interface was observed as a result of carbon segregative to the interface. A computer calculation was used to theoretically estimate the resultant concentration profiles after cooling. A nonequilibrium redistribution of carbon occurred during cooling. Thus the concentration profile within 50 microns of the interface measured at room temperature was different from that established during the diffusion anneal. Calculated concentration profiles with supersaturations of 1.42 and 1.44 agree well with experimental data for two tungsten samples cooled at different rates. Dissert. Abstr.

N71-25873# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.
SURFACE-SENSITIVE MECHANICAL BEHAVIOR OF METALS
R. M. Latanision, A. J. Sedriks, and A. R. C. Westwood Feb. 1971 85 p refs
(Contracts N00014-70-C-0255; N00014-67-C-0498; N00014-70-C-0330)
(AD-720405; RIAS-TR-71-08C) Avail: NTIS CSCL 11/6

The effects of surface and environmental conditions on

the plastic flow and fracture of metals and alloys are reviewed, with particular emphasis on topics of current controversy. These include the effects of surface films and the hard-vs-soft surface layer controversy in the plastic deformation of metal monocrystals, and the influence of crack-tip chemistry, cathodically-produced hydrogen, brittle films and other parameters in stress-corrosion cracking.
Author (GRA)

N71-25875# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE MECHANISM OF THE VARIATION IN THE ABRASIVE WEAR RESISTANCE OF G13L STEEL AFTER HARDENING
V. N. Kashcheev et al 10 Dec. 1970 12 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chernaya Met. (Moscow), v. 12, no. 12, 1969 p 103–105
(AD-720379; FTD-MT-24-287-70) Avail: NTIS CSCL 11/6

The assignment of this study is to explain the mechanism of the effect of the hardening temperature on the change in resistance to abrasive failure of G13L alloys of standard composition and with additions of niobium, which in the optimum concentration (0.3-0.4%) noticeably improves their abrasive wear resistance both in the cast, and in the tempered states. Author (GRA)

N71-25876# Aluminum Co. of America, New Kensington, Pa. Alcoa Research Labs.
INVESTIGATION TO DEVELOP A HIGH STRENGTH STRESS-CORROSION RESISTANT NAVAL AIRCRAFT ALUMINUM ALLOY Final Report, 16 Dec. 1969–16 Sep. 1970
J. T. Staley 20 Nov. 1970 114 p refs
(Contracts N00019-70-C-0118; N00019-69-C-0292)
(AD-720398) Avail: NTIS CSCL 11/6

The report presents the results of an evaluation of three tempers of commercially fabricated alloy MA15 plate in 1 in. to 6 in. thickness. Compared at equal strengths, MA15 developed higher resistance to stress-corrosion cracking, greater resistance to exfoliation corrosion, higher toughness, and better fatigue performance than established commercial aluminum alloys. Compared at equal resistance to stress-corrosion cracking, MA15 developed substantially higher strength than established commercial aluminum alloys. Field testing of this material is recommended.
Author (GRA)

N71-25891*# Battelle Memorial Inst., Columbus, Ohio.
VACUUM MELTING AND CASTING OF SUPERALLOYS
M. C. Hebeisen, H. J. Wagner, S. G. Nelson, C. A. Alexander, E. L. Foster et al Washington NASA 1971 179 p refs Sponsored by NASA
(NASA-SP-5095) Avail: NTIS CSCL 11F

The compositions, properties, and applications of nickel base and cobalt base superalloys are discussed. Processes using vacuum melting, vacuum induction melting, vacuum arc melting, electron beam melting, and vacuum casting are described. Furnaces, crucibles, and auxiliary apparatus used in commercial and experimental developments are specified. P.N.F.

N71-25903* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METHOD OF PLATING COPPER ON ALUMINUM Patent
James C. McConnell, inventor (to NASA) Issued 23 Sep. 1969 4 p Filed 4 Aug. 1966 Cl. 204-33; Int. Cl. C23b5/20
(NASA-Case-XLA-08966-1; US-Patent-3,468,765; US-Patent-Appl-SN-570678) Avail: US Patent Office CSCL 11F

A method of recovering an aluminum article having a thin copper plating with excellent adhesion characteristics is discussed. The method comprises degreasing the aluminum surface, anodizing the clean surface in a phosphoric acid solution, washing with water and live entry transferring the wet aluminum substrate to an aqueous acid-copper plating tank under controlled conditions.
Official Gazette of the U.S. Patent Office

N71-25915# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STRUCTURE OF THE DIFFUSION LAYERS AND THE PROPERTIES OF THE ZhS6K ALLOY ALUMINIZED BY THE CIRCULATION METHOD
D. A. Prokoshkin et al 10 Dec. 1970 11 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Mashinostr. (Moscow), no. 1, p 123–125
(AD-720370; FTD-MT-24-301-70) Avail: NTIS CSCL 11/6

The structure of the diffusion layers of the ZhS6K alloy after gas aluminization by the circulation method, and also the effect of aluminizing on the heat resistance and lasting strength of the alloy is studied. Comparative research of these properties after aluminizing the alloy by circulation method and in a powder mixture was accomplished. Author (GRA)

N71-25934*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STRESS INTENSITY FACTOR FOR A CRACKED SHEET WITH RIVETED AND UNIFORMLY SPACED STRINGERS
C. C. Poe, Jr. Washington May 1971 63 p refs
(NASA-TR-R-358; L-6826) Avail: NTIS CSCL 11F

The stress-intensity factor and forces in the most highly loaded rivet and stringer were calculated for a cracked sheet with riveted and uniformly spaced stringers. Two symmetrical cases of crack location were considered; the case of a crack extending equally on both sides of a stringer and the case of a crack extending equally on both sides of a point midway between two stringers. The complete results are presented on design graphs for systematic variations of crack length, rivet spacing, stringer spacing, and stringer stiffness. The results show that the stress-intensity factor for the stiffened sheet is significantly less than that for an unstiffened sheet, except for crack lengths much less than the stringer spacing. Also, the forces in the most highly loaded stringer and rivet asymptotically approach limiting values for increasing crack length. The stress-intensity factor and the limiting values of the stringer and rivet forces are smaller for stiffer or more closely spaced stringers or for more closely spaced rivets. Author

N71-25946# National Bureau of Standards, Washington, D.C. Metallurgy Div.
ELECTROTRANSPORT IN COMMERCIALLY PURE ALUMINUM [ELEKTROPERENOS V TVERDOMU ALYUMINYU]
R. P. Kuzmenko et al 1970 7 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), no. 4, 1969 p 401–402
(DMDC-182; TT-70-57009) Avail: NTIS CSCL 11F

Electrotransport of commercially pure Aluminum is studied by a weight difference technique. The temperature range is 500 to 570 C. A current density of 170 to 246 amp/sq mm was used. Aluminum was found to migrate to the anode at a rate of one to several microns per hour, depending on temperature.
Author (GRA)

N71-25949# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LOW CYCLE FATIGUE OF STRUCTURAL ALLOYS IN RELATION TO THEIR PLASTICITY
R. N. Sizova 30 Nov. 1970 20 p refs Transl. into ENGLISH from the Russian
(AD-720368; FTD-MT-24-248-70) Avail: NTIS CSCL 11/6

A study was made of the low-cycle fatigue life of martensitic steel EI-961F, EI-961, SN3, SN2A, VNS-2, chromium-nickle steels EI-696M, EI-835, nickel alloy VKh-101, copper alloy BrKhO-8, and aluminum AK-4. The fatigue tests were made with smooth and

notched samples. For notched samples, relations between stress and number of cycles are presented. No such relations for unnotched samples could be found. The mechanism of the low cycle fatigue rupture is discussed. GRA

N71-26043*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

A MECHANICAL PROPERTY AND STRESS CORROSION EVALUATION OF MP 35N MULTIPHASE ALLOY

J. W. Montano 10 May 1971 31 p refs

(NASA-TM-X-64591) Avail: NTIS CSCL 11F

The mechanical properties of solution treated, work strengthened, and age hardened, MP 35N multiphase alloy bar stock are presented. Test specimens manufactured from approximately 1.0 inch (2.54 cm) diameter bar stock were tested at temperatures of 75 F (23.9 C) to −423 F (−253 C). The test data indicated excellent tensile strength, ductility, and impact properties. Results of the alternate immersion stress corrosion tests on stressed and unstressed tensile specimens 0.125-inch (.3175 cm) diameter and transverse C-ring specimens machined from 1.0 inch (2.54 cm) diameter bar indicated that the material is unsusceptible to stress corrosion cracking when tested in 3.5 percent NaCl solution for 180 days. Author

N71-26046# Dayton Univ. Research Inst., Ohio.

MECHANICAL PROPERTY EVALUATION OF BETA FORGED Ti-6-Al-4 V Technical Report, Jul. 1968 Jun. 1970

Gerald J. Petrak Jan. 1971 44 p refs

(Contract F33615-69-C-1471)

(AD-720828; UDRI-TR-70-34; AFML-TR-70-291) Avail: NTIS CSCL 11/6

The mechanical properties of forged Ti-6Al-4V forged in the conventional manner and at temperatures above the alpha-beta/beta transus were investigated. Tensile, fatigue, stress rupture, and fracture properties of the optimum beta-forged material were determined. It was shown that the material forged in the beta range exhibits superior room temperature fracture and fatigue properties while the other mechanical properties are not affected. At 600F the fatigue, stress rupture, and tensile properties of the conventional forged and beta-forged material are the same. Author (GRA)

N71-26132*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.

PRECIPITATION STRENGTHENED TANTALUM BASE ALLOYS

R. W. Buckman, Jr. and R. C. Goodspeed Washington NASA May 1971 186 p refs

(Contract NAS3-2542)

(NASA-CR-1642; WANL-PR-(Q)-017) Avail: NTIS CSCL 11F

Precipitation strengthened tantalum base alloys were developed for application as sheet and tubing in advanced Rankine cycle space nuclear power systems. The Ta-W-Hf-C alloy system with additions of Re, Mo, Zr, and N was studied. Alloy compositions were selected to provide the best high temperature creep properties and still maintain good fabricating and welding characteristics. Screening studies were made on nonconsumable electrode melted ingots weighing 1-3/4 lb. and consumable electrode melted 2 inch diameter ingots weighing 7 lbs. All evaluations were made on 0.04 inch thick sheet. The results of the initial investigations led to the development of ASTAR-811C (Ta-8W-1Re-0.7Hf-0.025C) which exhibited creep strength at 2400 F approximately double that of T-111 (Ta-8W-2Hf). The ductility and fabricating characteristics of ASTAR-811C are similar to T-111. The ASTAR-811C composition was scaled up to 4 inch diameter ingot and processed to sheet and evaluated in detail. Short time tensile properties, recrystallization and grain growth behavior, weldability, and creep properties were determined. Author

N71-26157# IIT Research Inst., Chicago, Ill.

DEVELOPMENT OF OXIDATION-RESISTANT HAFNIUM ALLOYS Final Report, 1 Sep. 1969 - 31 Aug. 1970

V. L. Hill and H. R. Nichols 30 Sep. 1970 67 p refs

(Contract N00019-70-C-0120)

(AD-720724; IITRI-B6099-4) Avail: NTIS CSCL 11/6

The objective of the program was to investigate oxidation-resistant hafnium-base alloys as cladding for columbium- and TANTALUM- base alloys. Oxidation behavior of other combinations of Group 4B-5B alloys was also studied. Clad composites consisting of Cb-752 and Ta-10W cald with Hf-Ta-Cr-B-Al and Hf-Ta-Cr-Si alloys were exposed at 2200, 2500, and 2700F. Oxidation life varied from about 100 hr at 2200F to 25 hr at 2700F. Failure of the composites generally occurred at edges between the picture frame and substrate. The Hf-Ta-Cr-B-Al alloy indicated greater tolerance to surface defects than the Hf-Ta-Cr-Si alloy. Oxidation studies of modified Group 4B-5B alloys at 2000-2500F showed that oxidation resistance could be developed in several systems. The minor alloying additions employed were chromium, boron, columbium, silicon, yttrium, vanadium, and combinations of these elements. Chromium-silicon additions were the most effective in improving oxidation resistance in nearly all systems, although Cr-Al-Si combinations were also effective in Cb-Ti alloys. X-ray diffraction examination of oxides developed in oxidation-resistant hafnium-base alloys suggested that the oxide structures, probably a complex Hf-Ta oxide, were similar for all alloys. A model for the oxidation resistant obtained in Hf-Ta alloys is proposed. Author (GRA)

N71-26159# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

NEW CHROMIUM-BASE MATERIAL WITH MAGNESIUM OXIDE ADDITIVES

V. I. Khodkin, L. V. Semina, and M. I. Gerasimova 23 Nov. 1970 14 p Transl. into ENGLISH of the GERMAN book

(AD-720389; FTD-HT-23-605-70) Avail: NTIS CSCL 11/6

The properties of dispersion-strengthened chromium-base alloy containing 3-9 percent MgO have been investigated. Additions of up to 5 per cent MgO increased the alloy compactibility because MgO acts as a lubricant. Increasing the MgO content above 5 percent resulted in a lower density of the alloy due to the increasing magnitude of elastic aftereffects. MgO improved the sinterability of the alloy by forming binary compounds (spinels) with the Cr sub 2 O sub 3 existing on the surface of Cr powder particles which retards the sintering process. The strength and plasticity of the alloy increased with increasing MgO content. The presence of MgO also retarded the grain growth in the deformed alloy at temperatures up to 1400-1500 degrees C. GRA

N71-26225 Kentucky Univ., Lexington.

THE INFRARED REFLECTANCE SPECTRA OF CO AND O2 ADSORBED ON ORIENTED NICKEL FILMS

Glen Gray Possley (Ph.D. Thesis) 1969 125 p

Avail: Univ. Microfilms Order No. 70-12368

The infrared spectra of carbon monoxide and oxygen adsorbed on oriented nickel films were studied. The region of the spectrum covered was from 4000 to 30/cm. The films were oriented by deposition in a one torr rare gas atmosphere. High and ultrahigh vacuum systems were utilized to study the effects of the adsorbed gases. No special spectral differences were observed from films formed under high or ultrahigh vacuum as all of the films were reproducible. A band attributed to carbon monoxide adsorbed on nickel occurred around 2056/cm. This band is thought to be caused from carbon monoxide adsorbed linearly on nickel. The mode of adsorption could be chemical or physical or both. The interpretation of two bands centered around 568/cm and 465/cm was attempted and their exact interpretation could help to decide which kind of adsorption is occurring. Dissert. Abstr.

N71-26314 Southern Methodist Univ., Dallas, Tex.
THE TOTAL HEMISPHERICAL THERMAL EMITTANCE OF COPPER AS A FUNCTION OF THE DEGREE OF OXIDATION IN THE TEMPERATURE RANGE 700-1400 F
Robert Lelon Reid (Ph.D. Thesis) 1969 133 p
Avail: Univ. Microfilms Order No. 70-13223

The effect of the degree of oxidation on the emittance of copper for application to copper radiation shields or multifoil insulation systems containing copper foils. The specimens consisted of thin copper discs that were hollow and composed of two pieces. The specimens were oxidized in ambient air and the emittance measured in vacuum in a spherical enclosure. Emittance data for specimens prepared by surface grinding were taken for oxidation at various times at 300, 400, 500, and 600 F and for unoxidized copper. An uncertainty analysis showed that the emittances obtained were within 2.8 to 3.8% for unoxidized and heavily oxidized copper and within 4.8 to 16.0 for intermediate stages of oxidation. A parabolic oxide thickness equation was found to correlate the data satisfactorily. A two flux model was also investigated to correlate the data. Although the model appeared somewhat deficient, equations were derived from the model that will allow approximate calculation of the emittance. Some data were also obtained for surfaces finished on an automatic lapping machine and oxidized at 500 F. Dissert. Abstr.

N71-26382# Commissariat a l'Energie Atomique, Bruyares-le-Chatel (France). Centre d'Etudes.
TRITIUM DETERMINATION IN METALS BY COMBUSTION IN OXYGEN [DOSAGE DU TRITIUM DANS LES METAUX PAR COMBUSTION SOUS OXYGENE]
Jean-Louis Truffier and Philippe Corpechot Dec. 1970 41 p refs In FRENCH
(CEA-R-4020) Avail: AEC Depository Libraries

A description is given of the method used experimentally for determining tritium contained in metals. The tritium is extracted in the form of tritiated water by burning the sample in a sealed quartz tube filled with oxygen and heated to a high temperature. A calibration method is proposed, and a description is given of the results obtained on samples of iron, copper, and magnesium. Author (NSA)

N71-26393# National Bureau of Standards, Washington, D.C.
MICROBIAL CORROSION Technical Summary Report, 1 May 1969–30 Apr. 1970
Warren P. Iverson and Joan Churney May 1970 41 p refs
(Contract NAONR-10-70)
(AD-720693; NBS-10511; TSR-3) Avail: NTIS CSCL 11/6

The studies on microbial corrosion described in the report emphasize the mechanisms of anaerobic corrosion produced by sulfate-reducing bacteria, primarily those in the genus Desulfovibrio. As a pure culture of a marine strain of Desulfovibrio had been isolated and a satisfactory plating medium, trypticase - sea water agar, for isolation and maintainance of the strain had been developed, no further investigations in this area were carried out. In previous studies, two iron phosphides, Fe2P and Fe3P were identified as products produced by Desulfovibrio in the presence of Fe(++) ions. Further studies of an organo-phosphorus compound produced by these organisms, which appeared to be involved in the formation of iron phosphides were continued. Investigations of the corrosion rate of mild steel in the trypticase sea water medium, in the presence and absence of Fe(++) ions, by polarization techniques, were continued. Author (GRA)

N71-26409*# National Academy of Sciences–National Research Council, Washington, D.C. Committee on Coatings.
HIGH TEMPERATURE OXIDATION RESISTANT COATINGS. COATINGS FOR PROTECTION FROM OXIDATION OF SUPERALLOYS, REFRACTORY METALS, AND GRAPHITE
1970 231 p refs
(Contract NSR-09-012-910)
(NASA-CR-118647) Avail: NTIS; Printing and Publishing Office, NAS-NRC, 2101 Constitution Ave., Washington, D.C. 20418 CSCL 11C

The results are presented of a task force program to review the status of coatings for high temperature materials, including superalloys, refractory metals, and graphite; to consider the present research and development under way; and to recommend modifications in scope and emphasis. The general conclusions and recommendations of the task force are outlined followed by seperate reports dealing with: (1) fundamentals of coating systems, (2) state of the art of coating-substrate systems, (3) applications for coating systems, (4) manufacturing technology, and (5) testing and inspection.

N71-26480# Dayton Univ. Research Inst., Ohio.
ELECTRON MICROBEAM PROBE CHARACTERIZATION OF Al-Cu ALLOYS WITH Al AND Cu SOFT X-RAY SPECTRA Technical Report, Oct. 1969–Jun. 1970
James S. Solomon and William L. Baun (AFML, Wright-Patterson AFB, Ohio.) Wright-Patterson AFB, Ohio AFML Dec. 1970 30 p refs Prepared jointly with AFML, AFSC, Wright-Patterson AFB, Ohio
(Contract F33615-69-C-1330)
(AD-720261; AFML-TR-70-253) Avail: NTIS CSCL 11/6

Al-Cu alloys were characterized with an electron microbeam probe X-ray analyzer by examining the effects of alloying on AlK beta and CuL alpha X-ray emission spectra, and relating these effects to alloy composition. These effects include changes in spectra shapes, changes in intensity relationships, and band shifts. This method can be used to complement or substitute for the usual electron microbeam probe quantitative analysis. Speed and accuracy in measuring spectral changes are accomplished by using an automatic data acquisition and handling system that provides computer plotted spectra as well as a tabulated data printout. Two model Al-Cu systems were studied -- a diffusion couple and hypervelocity impact specimens. Author (GRA)

N71-26523 Missouri Univ., Rolla.
CALORIMETRY OF ROOM TEMPERATURE DEFORMED COPPER
George Juri Filatovas (Ph.D. Thesis) 1969 170 p
Avail: Univ. Microfilms Order No. 70-11760

An adiabatic anisothermal differential calorimater for the study of room temperature deformed 99.999% pure copper has been constructed. An annealed and a deformed specimen were heated at a constant rate in adiabatic surroundings and the differences in energy released between samples was obtained. The control circuits were automatic. Deformation was by elongation ranging from 12 to 40%, and the corresponding energy found was from 1.9 to 5.3 calories/gram-atom. No recovery energy was found. It is proposed that the criteria for the presence of recovery energy in the annealing spectrum of room temperature deformed metals is a high stacking fault energy and/or the presence of impurities, and that the recovery energy is mainly due to the relaxation of dislocations from high energy configurations. Dissert. Abstr.

N71-26524 Brown Univ., Providence, R.I.
THE STRENGTHENING OF ALUMINUM DUE TO ITS CAST MICROSTRUCTURE MODIFIED BY SILICON
Erk Erginer (Ph.D. Thesis) 1969 206 p
Avail: Univ. Microfilms Order No. 70-8713

The microstructural dependence of the strengthening of aluminum by silicon in cast alloys. Commercially pure aluminum and aluminum-silicon alloys with up to 50 weight % silicon were cast, and the mechanical properties of as-cast, annealed and

precipitation heat treated alloys were obtained in tension. Light microscopy revealed the microstructure on which the microstructural parameters were measured. The experimental data which lead to a single strength equation with different characteristic distances indicate that the effective strengths of the grain, dendrite cell and dislocation cell boundaries are equal. The strength of the barriers can be represented by one Petch slope, K, the value of which increases with plastic deformation in the work hardening range of the alloys. Dissert. Abstr.

N71-26616 Wisconsin Univ., Madison.
THE PLASTIC DEFORMATION OF gamma AgZn AND gamma CuAl
Alan Ray Beery (Ph.D. Thesis) 1970 135 p
Avail: Univ. Microfilms Order No. 70-8262

Poly and single crystals of the gamma brass phases gamma-AgZn and gamma-CuAl were subjected to constant strain rate compression tests over a wide range of temperatures. Both phases showed three temperature regions of mechanical behavior: a low temperature region where the compounds deformed in an elastic manner until brittle fracture occurred, an intermediate temperature region where brittle fracture and plastic flow appeared to be competing, and a high temperature region where only plastic flow occurred. The boundaries of the temperature regions were found to shift to higher temperatures with faster strain rates. The onset of plastic behavior, in the compounds, is believed to result from a reduction in the interlocking between atomic planes produced by lattice expansion and increased thermal vibration. This reduction in interlocking allows active glide planes to form. Dissert. Abstr.

N71-26661# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE STABILITY OF AUSTENITE FORMED IN SURFACE LAYERS DURING THE FRICTION OF HIGH STRENGTH CAST IRONS
L. I. Markovskaya 9 Dec. 1970 14 p refs Transl. into ENGLISH from the book "Litye Iznosostoikie Materialy" Kiev, Izd-Vo Naukova Dumka, 1969 p 45-50
(AD-720762; FTD-MT-24-279-70) Avail: NTIS CSCL 11/6

To determine the stability of austenite formed during friction in surface layers of high strength cast irons the amount of gamma-phase was monitored over a span of 4 years during friction. The amount of gamma-phase was independent of the pressure and of the slip rate. Then, the specimens with max. contents of gamma-phase in the surface layers were tempered in vacuum at 200-600 degrees. With increased heating temperature, the amount of austenite decreased. The amount of gamma-phase on the friction surface decreased sharply during the initial 30 min. of tempering at all temps. Extension of holding time to 3 hr at 200, 300, and 400 degrees did not practically change the amount of gamma-phase in the surface layer. However at 500 degrees the gamma-phase completely decompd. in 10 min. The x-ray patterns of high strength cast iron specimens labeled with C indicate that during wear the C concn. in the surface layers increased and decreased in the deeper layers. During friction intense plastic deformation and increased temps. prevail as a result of which diffusional processes take place which lead to redistribution of alloy components. In most cases the appearance of austenite in the surface layers leads to increased wear resistance. Author (GRA)

N71-26688# Indian National Scientific Documentation Centre, New Delhi.
INTERNAL STRESSES IN ELECTROLYTICALLY DEPOSITED METALS
M. Ya. Popereka 1970 361 p refs Transl. into ENGLISH of the publ. 'Vnutrennie Napryazheniya Elektroliticheski Osazh-Daemykh Metallov' Novosibirsk, Zapadno-Sibirsk. Knizhnoe Izd., 1966
Sponsored in part by NBS
(Contract NSF C-466)
(TT-68-50634) Copyright. Avail: Issuing Activity

Data are presented on problems of internal stresses in electrolytic deposits in connection with the structure of the deposit and the character of cathodic processes. Methods of measuring and calculating internal stresses are described and the influence of the conditions of electrolysis on the grain size of the deposits, the internal stresses, and cathodic polarization is examined. Data are included on the influence of a number of organic substances on the properties of the deposited metal and particular attention is given to the superimposition of alternating current during electrodeposition. A model mechanism for the development of internal stresses and information concerning the aging of electrolytic deposits of low-melting alloys is also presented. Author

N71-26725 Syracuse Univ., N.Y.
TRANSFORMATION PLASTICITY OF Fe-Ni DURING THE MARTENSITE REACTION
Richard Anthony Kot (Ph.D. Thesis) 1969 101 p
Avail: Univ. Microfilms Order No. 70-12786

Two Fe-Ni alloys (15.4% Ni; 32.9% Ni) have been studied during temperature cycling through the austenite reversible reaction martensite transformation under constant load. The typical linear relationship between the transformation strain per cycle and the externally applied stress for a material exhibiting transformation plasticity is obtained for both alloys. A dislocation model which takes into account the large shear strains generated by the martensite plate formation is proposed. It not only quantitatively predicts the stress dependence of the transformation strain per cycle but also predicts the log stress vs. log strain-rate behavior characteristic for transformation plasticity. The extent of transformation plasticity during isothermal tension tests for the two Fe-Ni alloys was also studied. Dissert. Abstr.

N71-26773* Hughes Aircraft Co., Los Angeles, Calif.
METHOD FOR REMOVING OXYGEN IMPURITIES FROM CESIUM Patent
John Robert Anderson, inventor (to NASA) Issued 23 Feb. 1971 3 p Filed 8 Nov. 1967 Cl. 75-66; Int. Cl. C22b9/08, 27/00 Continuation-in-part of US Patent Appl. SN-459596, filed 28 May 1965 Sponsored by NASA
(NASA-Case-XNP-04262-2; US-Patent-3,565,607; US-Patent-Appl-SN-684894) Avail: US Patent Office CSCL 11F

A method for purifying cesium of oxides contained therein is described. Cesium vapor is passed through a filter of porous tungsten heated to a temperature sufficient to cause dissociation of the oxides present, yet not so high as to ionize the cesium. Official Gazette of the U.S. Patent Office

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N71-25679# Pennsylvania State Univ., University Park. Dept. of Material Sciences.
RESEARCH ON GRAPHITE Summary Report, 1 Apr. 1970-31 Mar. 1971
P. L. Walker, Jr., D. E. Kline, and P. A. Thrower 31 Mar. 1971 50 p refs
(Contract AT(30-1)-1710)
(NYO-1710-100) Avail: NTIS

Research and development progress is reported on carbonization of anthracene, carbon formation from CO, graphitization

of pyrolytic carbon, gas-graphite interactions, solid state reactions, radiation effects on mechanical properties of graphite, and radiation damage in graphite. NSA

N71-25680# Gulf General Atomic, San Diego, Calif.
RESEARCH ON GRAPHITE Quarterly Progress Report, Period Ending 14 Nov. 1970
G. B. Engle, R. J. Price, and J. C. Bokros 24 Nov. 1970 23 p refs
(Contract AT(04-3)-167)
(GA-10433) Avail: NTIS

Previously irradiated graphites and new isotropic materials were studied to determine the effect of crystallite size, crystallite orientation, and density on dimensional and property changes. Preirradiation densities and thermal expansivities were also measured. Scanning electron microscope photographs revealed the shape, size, and surface texture of density fractions in a needle-coke graphite. Temperature-history effects on dimensional changes, the behavior of highly oriented graphites, and the changes in thermal conductivity were investigated, as well as the effect of coke structure on irradiation behavior. Density and X-ray parameters were measured and specimens were irradiated in the Dragon reactor to measure irradiation-induced creep in a number of graphites. NSA

N71-25767# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
FAILURE OF GLASS UNDER BIAXIAL LOADING Technical Report, Jan. – Dec. 1970
S. M. Wiederhorn and H. Johnson Dec. 1970 28 p refs Sponsored by ONR
(AD-717952; NBS-10510; TR-2) Avail: NTIS CSCL 11/2

The report presents the results of two studies on the fracture behavior of glass at elevated pressures. One was conducted in an inert environment at pressures up to 20 kbar. The other was conducted in water at pressures up to 7 kbar. Fracture mechanics techniques were used in both studies. In inert environment the fracture surface energy of three glass compositions was found to be independent of pressure suggesting that no change in the fracture mechanism occurs as a result of pressure. The brittle behavior of glass thus differs from plastics and metals which are observed to become stronger and more ductile with increasing pressure. The fracture behavior of glass in water was also observed to be insensitive to pressure. It is suggested that the reason for this null effect results from compensating mechanisms, in which the increase in fracture resistance arising from a positive activation volume for stress corrosion cracking process is balanced by a decrease in fracture resistance due to increased hydroxyl ion concentration at the crack tip. Author (GRA)

N71-25853 Du Pont de Nemours (E. I.) and Co., Wilmington, Del. Elastomer Chemicals Dept.
INFORMATION ABOUT URETHANE FOAM: PREPARATION OF POROUS-SURFACED HIGH-RESILIENCE MOLDED FOAMS
H. W. Wolfe, Jr. [1971] 4 p
Copyright. Avail: Issuing Activity

Flexible foam prepared by the one shot technique in closed molds normally has a skin which restricts the free passage of air in and out of the foam. Numerous methods, both chemical and mechanical, were devised to minimize the formation of skin. With most of these, only limited success was realized. High resilience (HR) foam prepared by the technique described in this bulletin contains no continuous skin membrane. The surfaces of the resulting foam are extremely porous; when checked with a Gurley Densometer, they show a flow of 300 cu in. of air in one half second or less. In molded foam prepared by the hot cure method, 25 to 35 seconds are generally required for the flow of 300 cu in. of air through the surface. Author

N71-25855# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Materials Lab.
HIGH STRENGTH, HIGH MODULUS GRAPHITE FIBERS
Herbert M. Ezekiel Jan. 1971 61 p refs
(AD-720824; AFML-TR-70-100) Avail: NTIS CSCL 10/3

The formation of high modulus and high strength graphite fibers from polymeric fibers and from fibers spun from pitches is reviewed. Methods of preparation given by patents and in the technical literature are abstracted for precursors including cellulose or rayon, polacrylonitrile, polyvinyl alcohol, polybenzimidazole, and aromatic polyamide yarns. The properties of the graphite fibers are given and relationships between various properties and methods of preparation are cited where these exist. Author (GRA)

N71-25877# Illinois Inst. of Tech., Chicago.
DEVELOPMENT OF IMPROVED INHIBITIVE PRIMERS Final Technical Report, 1 Oct. 1969 – 31 Oct. 1970
K. S. Rajan Dec. 1970 98 p refs
(Contract N00019-70-C-0180)
(AD-720384; IITRI-C6202-6) Avail: NTIS CSCL 11/3

The application of a number of different organic compounds as corrosion inhibitors was investigated in primers for aluminum and titanium alloys exposed to marine atmospheres. The candidate compounds belong to the classes of hydroxy-anthraquinones, lake-forming diazo compounds, phthaleins, triphenyl-methanes and phthalocyanines. 1-hydroxyanthraquinone, Na-phthalocyanine, pyrocatechol violet and orange II (azo dye) compared favorably with alizarin for aluminum. Further, these studies opened up the possibilities of a wide range of organic compounds for corrosion inhibition investigations. The bleed-through behaviour of alizarin through epoxy topcoat was observed to be obviated by using 1:1 alizarin:strontium chromate. Na-phthalocyanin and pyrocatechol violet-based primers did not show this bleed-through behavior. Results of the investigations on stress corrosion of titanium Ti-6A1-4V alloy did not prove conclusive. Author (GRA)

N71-25881* Hughes Aircraft Co., Los Angeles, Calif.
FLEXIBLE REPAIRABLE, POTTABLE MATERIAL FOR ELECTRICAL CONNECTORS Patent
Robert A. Dunsetz and Philip C. Crepeau, inventors (to NASA) Issued 2 Mar. 1971 3 p Filed 16 Apr. 1968 Cl. 260-37; Int. Cl. C08g23/14 Sponsored by NASA
(NASA-Case-XGS-05180; US-Patent-3,567,677; US-Patent-Appl-SN-721607) Avail: US Patent Office CSCL 11D

A flexible, repairble, pottable composition of matter suitable for encapsulating electrical connectors was prepared comprising diglycidyl ether of biaphenol A, diepoxide of polyglycol, and one or more amine curing agents. Optionally, the composition can contain one or more fillers in amounts which vary with the composition viscosity desired. Official Gazette of the U.S. Patent Office

N71-25885# Illinois Inst. of Tech., Chicago.
INVESTIGATION OF THE INFLUENCE OF MATERIAL VARIABLES ON FATIGUE MECHANISMS IN COMPOSITES Final Report, 1 May – 30 Nov. 1970
P. N. Rao and K. E. Hofer, Jr. Dec. 1970 72 p refs
(Contract N00019-70-C-0378)
(AD-720398; IITRI-D6058-FR) Avail: NTIS CSCL 11/4

The investigation pursued the following areas: (1) Determination of the static and fatigue characteristics of graphite/epoxy composite of current interest to the NASC (Modmor II (HTS)/Narmco 5208 prepreg). (2) Variation of temperature, stress mode and stress ratio. (3) Utilization of optical and scanning electron microscopic techniques in conjunction with sectioning of the samples to determine the feasibility of following the progress of fatigue cracking in these graphite composites. (4) Variation of fabrication processing (use of glass scrim cloth interlayers). Author (GRA)

N71-25886# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DETERMINING THE CONCENTRATION OF MOTOR OIL ADDITIVES PRESENT TOGETHER AND CONTAINING THE SAME METALS

V. E. Bashaev et al 30 Nov. 1970 8 p Transl. into ENGLISH from Prisadki i Smaz. Maslam (USSR), no. 2, 1969 p 207-210
(AD-720377; FTD-HT-23-721-70) Avail: NTIS CSCL 11/8

It is shown that the dependence of surface tension in oil on temperature and additive content can be used to determine the concentrations of additives even if these additives have identical metals in them. For oil with a blend of the barium-containing additives SB-3 and BFK, empirical relationships are derived which enable the calculation of these additive concentrations based on the values of surface tension in the oil, determined at temperatures of 15 and 20 degrees centigrade. Author (GRA)

N71-25894# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HIGH TEMPERATURE FRICTION

M. M. Krasnoshchekov et al 15 Dec. 1970 17 p refs Transl. into ENGLISH from the Russian
(AD-720367; FTD-MT-24-243-70) Avail: NTIS CSCL 20/11

Analysis of the work conducted in areas of study of the processes of friction and wear at elevated temperatures shows that along with the determined successes in the question of designating antifriction materials for these conditions there is a number of unsettled problems. To them belong, first of all, the problem of selecting heat-resistant antifriction materials for work in friction points under conditions of airless media: in inert and carbon dioxide gases, liquid-metal and water heat-transfer agents, and also under conditions of irradiation by different forms of radiation. Author (GRA)

N71-25895# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SYNTHESIS AND STUDY OF A POLYFUNCTIONAL POLYMERIC ADDITIVE

A. Kuliev et al 28 Dec. 1970 11 p refs Transl. into ENGLISH from Prisadki k Smaz. Maslam (USSR), no. 2, 1969 p 23-26
AD-720369; FTD-MT-24-284-70) Avail: NTIS CSCL 11/8

The preparation and properties of a polymeric sulfur-, phosphorus-, and nitrogen-containing lubricant additive possesses high detergent, dispersing, anticorrosion and antioxidant properties is described. GRA

N71-25945# Air Force Systems Command Wright-Patterson AFB, Ohio. Foreign Technology Div.

A STUDY OF ALUMOSILICONIZED DIFFUSION LAYERS ON NICKEL-CHROMIUM ALLOY

G. V. Zemskov et al 25 Nov. 1970 11 p refs Transl. into ENGLISH from Khim. Term. Obrab. Stali Splavov (Moscow), no. 6, 1969 p 96-100
(AD-720365; FTD-HT-23-845-70) Avail: NTIS CSCL 11/3

In the study of alumosiliconized coatings, the following differences from calorized coatings were observed: (1) the presence of 5-7% Si; (2) increased aluminum content and a correspondingly decreased nickel content; (3) a reduction in the number of other phases, besides the phase on a Ni2Al3 base. All the indicated differences contribute to the heightened oxidation resistance of the complex diffusion layer. Author (GRA)

N71-26015# Rutgers Univ., New Brunswick, N.J. School of Ceramics.

STUDIES OF CERAMIC PROCESSING Final Report, 16 Feb. 1967 - 30 Jun. 1969

Edward J. Smoke, Walter C. Jacobs, and Dennis R. Mangino Aug. 1970 127 p refs
(Contract N00019-67-C-0287)
(AD-720383) Avail: NTIS CSCL 11/2

The overall objectives were to improve structure and engineering properties, and to lower the firing temperature yet retain all engineering properties including refractoriness. Magnesium spinel was selected for study in the highest temperature range and cordierite for the lowest. Reactive spinel was prepared from pure alums by prereacting at 1150C. Four variables were studied namely composition, firing temperature, firing atmosphere and soak time. Structure studies were included and proposed sintering mechanisms for this compound are presented. In the lowest temperature range cordierite was selected. A single glass system was devised in which the desired cordierite content and content of the desired bonding glass could be fritted into one glass. During sintering of specimens prepared of the communited frit, cordierite was devitrified and the body matured. Sintering behavior versus a number of properties was studied along with structure and the devitrification behavior of the cordierite phase. The anticipated structure improvement was realized and the fact established that the composition of the bonding glass is critical. Author (GRA)

N71-26047*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ELECTRON PARAMAGNETIC RESONANCE STUDY OF TWO SMECTIC A LIQUID CRYSTALS

George C. Fryburg, Edward Gelerinter, and Derry L. Fishel Washington May 1971 15 p refs
(NASA-TN-D-6289; E-6102) Avail: NTIS CSCL 20B

The molecular ordering in two smectic A liquid crystals was studied by using vanadyl acetyl-acetonate as a paramagnetic probe. The average hyperfine splitting of the spectrum in the smectic A mesophase as a function of orientation relative to the direct current magnetic field of the spectrometer was also measured after the molecules of the liquid crystal were alined by cooling from the nematic mesophase in a magnetic field. Alining fields of 3300 and 11,000 gauss were used. The 4-butyl oxybenzyl idene-4-acetoaniline exhibited a monotonically increasing order with decreasing temperature throughout its nematic and smectic A mesophases. The 4-octyl oxybenzyl idene-4prime-ethylaniline displayed an abrupt change in molecular order at the nematic - smectic A transition. If alined in a 3300 gauss field, the order apparently decreased. If alined in an 11,000 gauss field, the order apparently increased. The different behavior of the two compounds may be explained on the basis of their different heats of transition. The orientation studies indicated that, if the molecules of the liquid crystal were alined in the smectic A mesophase, they maintained this alinement upon rotation in the magnetic field of the spectrometer. Author

N71-26100* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THERMAL PROTECTION ABLATION SPRAY SYSTEM Patent

William M. Haraway, Jr., inventor (to NASA) Issued 5 Jan. 1971 5 p Filed 31 Jul. 1967 Cl. 117-104; Int. Cl. B44D1/08; Int. Cl. C03c25/02
(NASA-Case-XLA-4251; US-Patent-3,553,002; US-Patent-Appl-SN-657742) Avail: US Patent Office CSCL 11D

A method of making and applying a sprayable fiber reinforced ablation material having a variety of fragile filler ingredients is discussed. Official Gazette of the U.S. Patent Office

N71-26139# Watervliet Arsenal, N.Y.

TENSILE TESTING OF INORGANIC WHISKERS

Iqbal Ahmad Dec. 1970 64 p refs
(AD-720571; WVT-7042) Avail: NTIS CSCL 11/2

The technique for the measurement of elastic modulus and tensile strength of fine filaments and whiskers, using the Marsh

machine, has been evaluated. Influence of heat cycle of diphenyl carbazide, gauge length of the specimen, and stiffness of the machine on the strain measurement has been determined and discussed. Tensile strength and elastic modulus data of whisker phase including NiO, W18O49, W20O58, WO3, CaB6, gamma-TaB, beta-rhombohedral boron, and alpha A12O3, obtained by this technique, has been presented. Problem areas in the characterization of whiskers have been indicated. Author (GRA)

N71-26149# Research Inst. of National Defense, Sundbyberg (Sweden).
INHIBITORS AGAINST TANK CORROSION. A STUDY VISIT TO OSLO, COPENHAGEN, AND BERLIN, AUGUST-SEPTEMBER 1969 [INHIBITORER MOT CISTERNKORROSION KONTAKT-OCH STUDIERESA TILL OSLO, KOEPENHAMN OCH BERLIN AUGUSTI-SEPTEMBER 1969]
P. Atterby and L. Schoen Nov. 1969 14 p refs In SWEDISH
(FOA-1-C-1332-92) Avail: NTIS

The use of inhibitors against corrosion in tanks and methods for testing them are discussed. A review is included of the discussions which took place in connection with trial projects exhibited in different laboratories. Author

N71-26153* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF PRODUCING REFRACTORY COMPOSITES CONTAINING TANTALUM CARBIDE, HAFNIUM CARBIDE, AND HAFNIUM BORIDE Patent
Max Quatinetz, John W. Weeton, and Thomas P. Herbell, inventors (to NASA) Issued 14 Oct. 1969 4 p Filed 25 Mar. 1966 Cl. 148-126; Int. Cl. C22c29/00; Int. Cl. B22f7/02; Int. Cl. C21d1/00
(NASA-Case-XLE-03940; US-Patent-3,472,709; US-Patent-Appl-SN-539255) Avail: US Patent Office CSCL 11D

Powders of refractory compounds are uniformly distributed throughout powders of a refractory metal matrix. The resulting mixture is densified by heat and pressure. Solution treatment follows in which a portion of the refractory compound is dissolved into a matrix to form a solid solution which is subsequently uniformly reprecipitated throughout the microstructure.
Official Gazette of the U.S. Patent Office

N71-26155* Goodyear Aerospace Corp., Akron, Ohio.
THERMALLY ACTIVATED FOAMING COMPOSITIONS Patent
Charles E. Welling, inventor (to NASA) Issued 2 Dec. 1969 4 p Filed 19 Sep. 1968 Cl. 260-2.5; Int. Cl. C08g22/44 Continuation-in-part of US Patent Appl. SN-553264, filed 25 May 1966 Sponsored by NASA
(NASA-Case-LAR-10373-1; US-Patent-3,481,887; US-Patent-Appl-SN-761007) Avail: US Patent Office CSCL 11D

A storage stable, thermally actuatable, foamable composition is described. The composition comprises a hydroxyl terminated prepolymer, 4, 4 prime- diphenyl methane diacyl azine, bisphenol adduct of 4, 4 prime- diphenyl methane diisocyanate, a surfactant and a catalyst. Official Gazette of the U.S. Patent Office

N71-26220# Naval Ordnance Lab., White Oak, Md.
ALIPHATIC IMIDE-QUINOXALINE COPOLYMERS Technical Report, Apr.-June, 1970
James V. Duffy and Joseph M. Augl 6 Jan. 1971 19 p refs
(AD-720687; NOLTR-70-245) Avail: NTIS CSCL 7/3

The preparation, characterization and evaluation of the thermal and solubility properties of four new ordered imide-quinoxaline copolymers are described. These copolymers were prepared via a condensation reaction between various ortho tetraamines and N,N-bis(4-benzilyl)-tetrahydrofuran tetracarboxylimide. Their thermal (PDTs 290-350C) and oxidative stabilities were governed by the tetrahydrofuran group in the polymer backbone. Polymer solubility was demonstrated in a variety of solvents and strong films and fibers were obtained from m-cresol solutions. Author (GRA)

N71-26222 City Univ. of New York.
MECHANISM OF THE OXIDATION OF TITANIUM DISILICIDE: 300-1300C
Frederic Nickels Schwettmann (Ph.D. Thesis) 1970 169 p
Avail: Univ. Microfilms Order No. 70-12964

TiSi2 wafers of 95% of theoretical density were fabricated by cold pressing of powders followed by sintering in vacuum. The structure of the growing oxide film was determined by metallography, X-ray diffraction, infrared spectroscopy and electron microscopy. In the entire temperature and pressure region, TiSi2 forms an adherent, protective oxide film. Two distinct oxidation regions are observed. At 300-600 C, the oxide film is entirely amorphous consisting of a titania-silica glass. The rate data can be interpreted in terms of a diffusion controlled model with a variable diffusivity. At temperatures over 600 C, the oxide consists of an amorphous silica matrix with crystalline TiO2 (rutile) islands. From 600-1000 C, a variable diffusivity model is applicable. From 1000-1300 C, the kinetics are parabolic with an activation energy of 21.3 kcal. In this region, diffusion through the silica film with a constant diffusivity is the rate controlling step. Dissert. Abstr.

N71-26223# Defense Documentation Center, Alexandria, Va.
PHOSPHATE COATINGS (INDUSTRIAL PROCESSING SERIES), VOLUME 2 Bibliography Report, Sep. 1961-Aug. 1969
Feb. 1971 38 p refs
(AD-720201; DDC-TAS-70-78-1-Vol-2) Avail: NTIS CSCL 11/3

The bibliography is the first volume of a two-volume set on Phosphate Coatings in a series of bibliographies on Industrial Processing. It includes 31 annotated references arranged in AD sequence and covers the period January 1953 to January 1971. Corporate author-monitoring agency, subject, title, and report number indexes are included. GRA

N71-26236*# Pennsylvania State Univ., University Park. Materials Research Lab.
OPTICAL PROPERTIES OF SILICON AND THE EFFECT OF IRRADIATION ON THEM
K. Vedam *In* JPL Proc. of the 3d Ann. Conf. on Effects of Lithium Doping on Silicon Solar Cells 1 Apr. 1971 p 93-100 refs (See N71-26226 14-03)
(Grant NGR-39-009-042)
Avail: NTIS CSCL 07E

A new ellipsometric method for the determination of both the real and imaginary parts of the complex refractive index (n2 ik2) of silicon are described. Measurements on cleaved samples of silicon reveal that the true values of silicon for 5461A are n2 = 4.14 + or - 0.02 and k2 = 0.03 + or - 0.01. Similar measurements on chemically polished samples yielded the values as n2 = 4.05 and k2 = 0.028. These results are also corroborated by electron microprobe studies on these same specimens. Optical absorption coefficient of intrinsic silicon has been determined at a number of discrete wavelengths in the spectral range 400-1000 nm at room temperature. These measurements were also extended to liquid nitrogen and liquid helium temperatures. Results of these measurements, in conjunction with our earlier measurements on the refractive index of silicon, provide reliable data on the optical constants of intrinsic silicon. Irradiation of silicon with 6-MeV protons does not produce any noticeable change in its optical properties, as determined by techniques involving reflectivity, within the limits of experimental error. Author

N71-26259# Forsvarets Forskiningsanstalt, Stockholm (Sweden).
CORROSION IN THE ATMOSPHERE [KORROSION I ATMOSFAER]
Per Atterby Nov. 1969 9 p refs In SWEDISH
(FOA-1-C-1333-92) Avail: NTIS

The main principles of atmospheric corrosion are considered. Examined are: air pollution, exposure to atmosphere, metals and metal alloys, painting, car corrosion, temporary protection against corrosion and out-stations for atmospheric exposure. The report concludes with five basic rules for sound common sense about corrosion. Author

N71-26285* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
FABRIC FOR MICROMETEOROID PROTECTION GARMENT Patent
Richard S. Johnston, inventor (to NASA) Issued 16 Feb. 1971 4 p Filed 31 Dec. 1969 Cl. 112-402; Cl. 2-275; Cl. 2-81; Int. Cl. D05b93/00
(NASA-Case-MSC-12109; US-Patent-3,563,198; US-Patent-Appl-SN-889376) Avail: US Patent Office CSCL 11E

A structure of fabric layers is arranged so as to eliminate heat shorts therethrough and comprises a plurality of individually grouped layers, each layer consisting of stacked fabrics. Each of the layers of stacked fabrics is stitched together in quiltlike fashion to form a unitary or integral body. The layers are laid one upon another in offset stitch manner, that is, with the stitch lines of each fabric being disposed intermediate the stitch line of the adjacent fabric so as to avoid a common heat transfer avenue through all layers. This protective garment can serve both as a heat and micrometeoroid barrier in selecting materials for space suits. Official Gazette of the U.S. Patent Office

N71-26288# Defense Documentation Center, Alexandria, Va.
REFRACTORY COATINGS (INDUSTRIAL PROCESSING SERIES), VOLUME 1 Bibliography Report, Apr. 1959–Jan. 1970
Feb. 1971 98 p refs
(AD-720203; DDC-TAS-70-79-1-Vol-1) Avail: NTIS CSCL 11/3

The bibliography is the first Volume of a two-volume set on Refractory Coatings in a series of bibliographies on Industrial Processing. It includes 61 annotated references arranged in AD sequence and covers the period January 1953 to January 1971. Corporate author-monitoring agency, subject, title, contract, and report number indexes are included. GRA

N71-26309# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METAL DIALKYLPHENYL PYROPHOSPHATES AS DETERGENT ADDITIVES FOR LUBRICATING OILS
A. M. Kuliev et al 22 Dec. 1970 7 p refs Transl. into ENGLISH from Prisadki k Smazochnym Maslam (USSR), no. 2, 1969 p 71–72
(AD-720743; FTD-HT-23-768-70) Avail: NTIS CSCL 11/8

The use as detergent additives of salts of pyrophosphates is proposed. The pyrophosphates are synthesized by the condensation of alkylphenylphosphoric acids by means of phosphorus pentoxide and subsequent treatment of the condensation products with barium hydroxide. The additive obtained is a pyrophosphate of barium; its composition includes 12.1% P and 16% Ba. Author (GRA)

N71-26315 California Univ., San Diego.
SPUTTER CONDENSATION OF SILICATES
Charles Meyer, Jr. (Ph.D. Thesis) 1969 159 p
Avail: Univ. Microfilms Order No. 70-13226

Silicate targets were sputtered in an argon glow discharge to produce a vapor of the constituent atoms. The resulting vapor was recondensed in a controllable manner onto substrates held at various temperatures. The general problem was to determine the crystal structure, composition, and textural relationships of the condensed phases as functions of the substrate temperature, and of the pressure, temperature, and composition of the gas components from which the solids grew. Finally, the observed infrared spectra of certain stars is interpreted to originate from silicate grains in the process of sputter-condensation. Dissert. Abstr.

N71-26383# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.
APPLICATION OF PHOTOCHROMIC COATINGS FOR NONDESTRUCTIVE INSPECTION Final Technical Report, Jan. 1969–Jul. 1970
Sidney Allinikov Dec. 1970 61 p refs
(AD-720239; AFML-TR-70-246) Avail: NTIS CSCL 14/2

The application of a photochromic compound to provide a nondestructive inspection (NDI) technique for aerospace materials and structures is discussed. The photochromic compound, incorporated into a paint formulation, is converted from a white to a bright violet color upon a brief irradiation from an ultraviolet source. The colored paint surface is then heated by any suitable means, such as a hot air blower. Heat serves to bleach the paint to the original white color. Defects are disclosed because heat conductivity at the defect site is different from that of the rest of the area under inspection. The defect thus appears as a colored or white area dependent upon the nature of the defect and originating direction of the heat source. Some of the types of defects and kinds of structures to which the NDI paint has been applied are discussed, along with advantages and limitations of the paint. Author (GRA)

N71-26384# Horizons, Inc., Cleveland, Ohio.
SYNTHESIS OF NEW LOW-TEMPERATURE PETROLEUM-RESISTANT ELASTOMERS Final Report, 18 May–18 Nov. 1970
Kennard A. Reynard and Selwyn H. Rose Dec. 1970 41 p refs
(Contract DAAG46-70-C-0075)
(AD-720215; AMMRC-CR-70-26) Avail: NTIS CSCL 11/10

Four petroleum-resistant elastomers have been developed which appear suitable for low temperature use. These materials are: (NP(OCH2CF3)2-NP(OCH2C3F7)2)n (1:1 and 2:1), (NP(OCH2CF3)2 - NP(OCH2C3F6CF2H)2)n, and (NP (OCH2CF2CF2H)2 - NP(OCH2C5F10CF2H)2)n. These elastomers have initial decomposition points in the range of 300 C in air. The 1:1 copolymer of (NP(OCH2CF3)2 - NP (OCH2C3F7)2)n has a Tg of –77C, is very inert chemically, and is soluble only in selected fluorocarbon solvents. The material does not burn in air even in a direct flame. The copolymers (NP(OCH2CF3)2 - NP(OCH2C3F6CF2H)2)n and (NP(OCH2CF2CF2H)2 - NP(OCH2C5F10CF2H)2)n, are highly elastic and are unaffected by hydrocarbons and benzene, but are soluble in many polar organic solvents. Other poly(phosphazenes) were prepared which had interesting and useful properties. Author (GRA)

N71-26406 Brown Univ., Providence, R.I.
ON THE STRESS ANALYSIS OF AN INHOMOGENEOUS TRANSVERSELY ISOTROPIC MATERIAL
Abdul-Majid K. Nusayr (Ph.D. Thesis) 1969 56 p
Avail: Univ. Microfilms Order No. 70-8770

A means of deducing the solution for the isotropic inhomogenous case from the corresponding solution for the anisotropic homogeneous solution is presented. It considers the case where the inhomogeneity is represented by a variation in Young's modulus E(x) of the type E(x) = (E sub 0) (1 + epsilon sin (2 pi x)/lambda) where E sub 0, epsilon, and lambda are constants and Poisson's ratio is constant. The solution given here is subject to the following conditions: (1) The planes of lamination are

perpendicular or parallel to the boundary of the body, (2) epsilon is small compared to 1, and (3) The characteristic dimensions of the body are large compared to lambda. Dissert. Abstr.

N71-28522# Commissariat a l'Energie Atomique, Saclay (France). Centre d-Etudes Nucleaires.
ELEMENTARY MODEL OF THE MACROSCOPIC EFFECTS OF NEUTRON IRRADIATION IN GRAPHITE [MODELE ELEMENTAIRE SUR LES EFFETS MACROSCOPIQUES D'IRRADIATION NEUTRONIQUE DANS LE GRAPHITE]
J. P. Genthon Jun. 1970 46 p refs In FRENCH
(CEA-N-1374) Avail: AEC Depository Libraries

A study of a structural model in zones of displacements of the defects created in graphite by neutron irradiation shows that, before any random thermal annealing, these zones are made up of 4 stable atomic displacements: 4 vacancies in groups of two, three and four vacancies and 4 interstitials, isolated or in groups of two, three and four interstitials (single vacancies and groups of 5 interstitials are possible in small proportions). The effects of irradiation temperature on the dimensional changes in irradiated graphite, as established from published experimental data, are illustrated from this model. In particular its application enables irradiation rate effects to be taken into account (problems of instantaneous flux or equivalent temperature correction). Author (NSA)

N71-28550 Akron Univ., Ohio.
CHARACTERIZATION OF ORTHROTROPIC (FIBER REINFORCED) POLYMERIC SOLIDS
John C. Halpin (Ph.D. Thesis) 1969 238 p
Avail: Univ. Microfilms Order No. 70-12664

The theoretical and experimental tools required for the specification of the physical properties and response of two dimensional orthotropic macromolecular solids are presented. The unique roles played by the anisotropic coupling coefficients, the shear coupling terms, the flexure-twisting coupling, and the stretching-twisting coupling have been examined in simple tension of slender rods, flexure of beams and for general uniaxial and biaxial loadings of thin walled anisotropic cylinders. The analysis and its experimental verification have led to new characterization procedures for fiber reinforced, laminated polymeric solids. Specific comments are directed to the deficiencies of netting analysis. Dissert. Abstr.

N71-28590# Nuklearni Institut Jozef Stefan, Ljubljana (Yugoslavia).
THERMAL TREATMENT OF Cr-SiO CERMET THIN FILMS
J. Gasperic and B. Navinsek Sep. 1970 8 p refs Presented at the Conf. on Thin Films, Cannes, France, 5 - 10 Oct. 1970
(IJS-587; CONF-701032-1) Avail: AEC Depository Libraries

Cr-SiO films were prepared in a Balzers evaporation unit using a BSF 101 flush evaporator. Cermet films were evaporated on pyrex, alumina, and fused quartz substrates at temperatures of 20 to 300 C. All substrates had preevaporated gold contacts. Films with and without SiO2 protection layer were stabilized and aged in vacuum at 200 to 550 C and in the atmosphere at 100 to 200 C. The following properties of evaporated cermet films were investigated: thickness and mass, chemical composition, resistivities, and temperature coefficients of resistance (TCR) using the Tolansky and microgravimetric method, the quartz microbalance method, X-ray fluorescence and microprobe analysis, electrical measurements, and a monopole mass analyzer (to study the influence of residual gases). Author (NSA)

N71-28772* IIT Research Inst., Chicago, Ill.
STABILIZED ZINC OXIDE COATING COMPOSITIONS
Gene A. Zerlaut, Daniel W. Gates, and William F. Carroll, inventors (to NASA) Issued 27 Apr. 1971 4 p Filed 11 Mar. 1968
Cl. 106-296; Int. Cl. C09c1/04 Continuation-in-part of US Patent Appl. SN-644449, filed 2 Jun. 1967 Sponsored by NASA
(NASA-Case-XMF-7770-2; US-Patent-3,576,656;
US-Patent-Appl-SN-711903) Avail: US Patent Office CSCL 11C

Zinc oxide-pigmented coating compositions for spacecraft thermal control are prepared by treating zinc oxide with an aqueous alkali metal silicate solution, redispersing the pigment in water and combining the treated pigment with a degradation resistant binder such as a silicone polymer. The silicate treatment renders zinc oxide pigment resistant to the degradation of reflective properties which would otherwise occur upon exposure to ultra-violet radiation in vacuum. Further improvements in pigment properties are obtained by seating the zinc oxide silicate reaction product prior to redispersion. Official Gazette of the U.S. Patent Office

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N71-25861# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
IDENTIFICATION OF NONLINEAR SYSTEMS USING A URYSON MODEL
Phillip G. Gallman and Kumpati S. Narendra Apr. 1971 26 p refs
(CT-38) Avail: NTIS

A series expansion of a class of bounded, continuous, time invariant causal, nonlinear operators is derived from the Stone-Weierstrass theorem and is used to characterize nonlinear systems. The first term of the series is a nonlinear operator and is used as a model for the identification of nonlinear systems. An iterative algorithm for estimating model parameters from recordings of the system input and noise corrupted output signals is presented and the practical utility of the model is demonstrated by computer simulation. Author

N71-25862# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
CONSTRAINED OPTIMIZATION PROBLEMS USING MULTIPLIER METHODS
Shiva S. Tripathi and Kumpati S. Narendra Jan. 1971 15 p refs
(CT-36) Avail: NTIS

The multiplier method is investigated and modifications to the method is suggested. In addition, the application of the modified algorithm to optimal control problems with terminal constraints is considered and a technique of treating optimal control problems with free terminal time in the framework of a gradient or a conjugate gradient method is also developed. Author

N71-25867# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
FURTHER CONSIDERATIONS OF VARIABLE-STRUCTURE STOCHASTIC AUTOMATA
R. Viswanathan and Kumpati S. Narendra Jan. 1971 11 p refs
(CT-37) Avail: NTIS

Stochastic automation with an input set containing finite number (> 2) of elements is considered and optimal schemes for varying the structure of automata are developed. Author

N71-25909# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.

OPTIMAL CONVERGENCE OF VARIABLE STRUCTURE STOCHASTIC AUTOMATA USING THE S-MODEL

R. Viswanathan and Kumpati S. Narendra Aug. 1970 14 p refs

(CT-34) Avail: NTIS

Several linear, nonlinear, and hybrid updating schemes for the P model resulting in unconditional optimality are reported. An attempt is made to extend these schemes to the case of the S model. It is shown that corresponding to each of the optimal P model structures it is possible to construct an updating scheme resulting in an optimal S model. A practical difficulty is however encountered while applying the S model to learning systems. A method of overcoming this difficulty as well as the problem of optimization of the performance of automata in periodic random environments are considered. Author

N71-26007# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.

ADAPTIVE ESTIMATION ALGORITHMS

Larry J. Levy Dec. 1970 180 p

(Contract N00014-68-A-0162)

(AD-720394; ERI-93400) Avail: NTIS CSCL 12/1

The study considers the problem of estimating the states of a linear discrete dynamical system when the covariance matrix, R, of the stationary white sequence corrupting the measurement and/or the covariance matrix, Q, of the stationary white input sequence are unknown. Two new adaptive estimators, called the Reprocessing Filter (RF) and the Maximum A Posteriori (MAP) estimator, are developed which jointly estimate the state variables and the unknown R and/or Q. The new feature common to both estimators is the use of easily implementable estimators of R and/or Q in a reprocessing configuration with the Kalman-filter algorithm. Author (GRA)

N71-26042*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

AN ALGORITHM FOR SOLVING THE POPOV CRITERION APPLIED TO SAMPLED DATA SYSTEMS

S. M. Seltzer 2 Apr. 1971 35 p refs

(NASA-TM-X-64600) Avail: NTIS CSCL 12A

A systematic means is provided for analytically solving the Popov stability criterion that was developed by Tsypkin for application to sampled data systems. It is developed in a manner that is amenable to solution by a digital computer, regardless of the order of the polynomials defining the numerator and denominator of the z-transform of the transfer function representing the linear part of the plant. Author

N71-26090*# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.

EXACT INTERVALS AND TESTS FOR MEDIAN WHEN ONE SAMPLE VALUE POSSIBLY AN OUTLIER

John E. Walsh 18 Dec. 1970 7 p

(Grant NGR-44-007-028; Contract N00014-68-A-0515; Proj. NR 042-260)

(NASA-CR-118510; SMU-TR-87) Avail: NTIS CSCL 12A

Continuous data n observations are available that are believed to be a random sample. Confidence intervals and significance tests for the population median are developed. However, there is the possibility that either the largest or the smallest observation is an outlier. That is, the population yielding this observation differs from the population yielding the other n - 1 observations. If this happens, intervals and tests are desired for the median of the population yielding the n - 1. It is found that two-sided intervals and tests based on two symmetrically located order statistics (not the largest and smallest) have this property. Also, some extensions are considered wherein each observation can be from a different population. Author

N71-26091*# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.

EXACT INTERVALS AND TEST FOR MEAN OF SYMMETRICAL POPULATION WHEN ONE SAMPLE VALUE POSSIBLY AN OUTLIER

John E. Welsh 1 Dec. 1970 9 p refs

(Grant NGR-44-007-028; Contract N00014-68-A-0515; Proj. NR 042-260)

(NASA-CR-118509; SMU-TR-88) Avail: NTIS CSCL 12A

The (continuous) data are n observations that are believed to be a random sample from a symmetrical population. Confidence intervals and significance tests for the population mean are developed. These results always involve both the next to largest and next to smallest observations and should have at least moderately high efficiencies. Also, some extensions are considered, such as allowing each observation to be from a different population. Author

N71-26098*# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.

APPROXIMATE INTERVALS AND TESTS FOR PRODUCTS AND RATIOS OF BINOMIAL PROBABILITIES

John E. Walsh 14 Dec. 1970 10 p refs

(Grant NGR-44-007-028; Contract N00014-68-A-0515; Proj. NR 042-260)

(NASA-CR-118511; SMU-TR-89) Avail: NTIS CSCL 12A

The data are the observed numbers of successes for sets of independent trials from binomial distributions (success and failure are the possible outcomes for each binomial event). Confidence intervals and tests for the product of the success probabilities for these bionomial distributions are developed. Intervals and tests for the product of a specified set of these probabilities divided by the product of the remaining probabilities are also developed. The situation of interest is that where, for all distributions, the success probabilities are of at least moderate size (say, at least 2/3) and the numbers of trials are at least moderately large. Approximate intervals and tests are obtained by use of logarithms, expansions, and normal approximations. These results have application in investigating and comparing system reliabilities. Author

N71-26099*# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.

NONPARAMETRIC ESTIMATION OF MEAN AND VARIANCE WHEN A FEW SAMPLE VALUES POSSIBLY OUTLIERS

John E. Walsh 18 Dec. 1970 8 p ref

(Grant NGR-44-007-028; Contract N00014-68-A-0515; Proj. NR 042-260)

(NASA-CR-118512; SMU-TR-91) Avail: NTIS CSCL 12A

The data (continuous) are n independent observations that are believed to be a random sample. The possibility exists, however, that as many as J of the largest observations, and as many as K of the smallest observations, are outliers. That is, these observations are from populations that are different from the population yielding the other observations (which number at least n-J-K). Suitable estimates for the mean and variance of the population yielding the other observations are obtained. Author

N71-26109# Alabama Univ., University. Dept. of Physics.

STABILITY OF AN AREA-PRESERVING MAPPING

B. Z. Jenkins and J. H. Bartlett 1 Jun. 1971 71 p refs

(Grant NSF GP-20122)

(TR-1) Avail: Issuing Activity

Schemes using eigencurves through hyperbolic fixed points requiring little repetition of mapping are examined, emphasizing the stability of orbits of the plane restricted three body problem. The mapping was found to possess fixed hyperbolic points having negative eigenvalues. J.A.M.

N71-28111*# Southern Methodist Univ., Dallas, Dept. of Statistics.
GENERALLY APPLICABLE N-PERSON PERCENTILE GAME THEORY FOR CASE OF INDEPENDENTLY CHOSEN STRATEGIES
John E. Walsh and Grace J. Kelleher 21 Dec. 1970 19 p refs
(Grant NGR-44-007-028; Contract N00014-68-A-0515; Proj. NR 042-260)
(NASA-CR-118513; SMU-TR-92) Avail: NTIS CSCL 12A

A discrete N-person game theory is considered where the players choose their strategies separately and independently. Payoff values can be of a very general nature and need not be numbers. However, the totality of payoff outcomes (N-dimensional), corresponding to the possible combinations of strategies, can be ranked by each player according to their desirability to that player. A largest level of desirability (associated with one or more outcomes (o sub i) occurs for the i-th player such that he can assure, with probability at least a given value alpha sub i, that an outcome with at least this desirability level is obtained, and this can be done simultaneously for all the players. This game theory is of a median nature when all the alpha sub i are chosen to the 1/2. A method is given for determining O sub i and an optimum (mixed) strategy for every player. Practical aspects of applying this percentile game theory are examined. Application effort can be substantially reduced when the players have relative desirability functions for ranking the outcomes. Some elementary types of relative desirability functions are introduced. Author

N71-28112*# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
SIMPLIFIED SOLUTIONS FOR TWO-PERSON PERCENTILE GAMES
John E. Walsh and Grace J. Kelleher 4 Jan. 1971 14 p refs
(Grant NGR-44-007-028; Contract N00014-68-A-0515; Proj. NR 042-260)
(NASA-CR-118514; SMU-TR-94) Avail: NTIS CSCL 12A

The solution of a two-person game is considered in which the players use percentile criteria. For player i, the stepwise procedure is to mark positions of the game outcomes in his payoff matrix according to decreasing desirability level (i = 1,2). The smallest marked set is to be determined such that, for percentile 100 alpha sub i used by player i, an outcome of the set can be assured with a probability at least alpha sub i. Also, an optimum mixed strategy is to be determined (for accomplishing this assurance). In general, the probability with which a marked set can be assured is evaluated by solution of a specialized zero-sum game with an expected-value basis. Easily evaluated upper and lower bounds for this probability can be obtained from the matrix locations of the markings. The probability is then determined without solution of a zero-sum game, and a corresponding optimum strategy is readily identified. The probability value is approximately determined when the bounds are nearly equal, and an approximately optimum strategy is easily identified. Indications are that many percentile games can be solved, exactly or approximately, by this simplified method. Author

N71-28113*# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
THEMIS SIGNAL ANALYSIS STATISTICS RESEARCH PROGRAM. ALWAYS USABLE LIMITED-LENGTH SEQUENTIAL PERMUTATION TESTS FOR TWO-WAY ANOVA
John E. Walsh 1 Oct. 1970 25 p refs
(Grant NGR-44-007-028; Contract N00014-68-A-0515; Proj. NR 042-260)
(NASA-CR-118515; SMU-TR-84) Avail: NTIS CSCL 12A

The data are independent observations from two or more sources. Under the null hypothesis, observations from the same source have a common unknown distribution. Observations are obtained in successive groups each containing a set of specified size from each source, with a stated maximum number of groups available. Exact null probabilities are obtainable, through use of appropriate permutation models and special kinds of subtest statistics. The subtests are such that the significance level of each new subtest is independent of preceding subtest results. Subtests are always included wherein the second and each following group is compared with the totality of previous groups to investigate whether observations from the same source continue to be from the same population. Ordinarily, a single comprehensive subtest occurs for each source. Also, an additional subtest could be made to investigate whether the first group satisfies the null hypothesis. Unconditional tests can be obtained when ranks are used and in some other cases. Some possible uses in quality control are outlined. Author

N71-28114*# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
THEMIS SIGNAL ANALYSIS STATISTICS RESEARCH PROGRAM. GENERALLY USABLE SEQUENTIAL RANDOMIZATION TESTS FOR TWO-WAY ANOVA THAT EMPHASIZE THE MORE RECENT DATA
John E. Walsh 1 Oct. 1970 28 p refs
(Grant NGR-44-007-028; Contract N00014-68-A-0515; Proj. NR 042-260)
(NASA-CR-118508; SMU-TR-85) Avail: NTIS CSCL 12A

The data are independent observations from two or more sources and observations from the same source have the same (arbitrary) distribution. Observations are obtained in successive groups each containing a set of specified size from each source. All observations are re-used until a specified number of groups occur. Then, independently for each source, a stated number of the observations from a source are chosen by randomization. Data for re-use are now the group of observations chosen by the randomizations and newly obtained groups. Additional groups are taken until the number for re-use reaches a given value. Then, independently for each source, a stated number of the observations in these groups from a source are chosen by randomization. The resulting group is the data for re-use at this stage. Additional new groups are taken, etc. Exact null probabilities are obtainable, through use of appropriate randomization models and special kinds of subtest statistics. Subtests are always included wherein the second and each following group is compared with the data for re-use, to investigate whether observations from the same source continue to be from the same population. Some possible uses in quality control are outlined. Author

N71-28115*# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
THEMIS SIGNAL ANALYSIS STATISTICS RESEARCH PROGRAM. ALWAYS APPLICABLE SEQUENTIAL RANDOMIZATION TESTS FOR ONE-WAY ANOVA THAT EMPHASIZE THE MORE RECENT DATA
John E. Walsh 1 Oct. 1970 21 p refs
(Grant NGR-44-007-028; Contract N00014-68-A-0515; Proj. NR 042-260)
(NASA-CR-118516; SMU-TR-83) Avail: NTIS CSCL 12A

The data are independent observations which, under the null hypothesis, have the same unknown (arbitrary) distribution. All observations are re-used until a stated totality occurs. Then, a specified number of these observations are chosen by randomization (all possibilities equally likely). Data for re-use thus consist of the observations chosen by randomization and newly obtained observations. New observations are taken until the totality for re-use reaches a given value. Then, a specified number of these observations are chosen by randomization and constitute the data for re-use at this stage. Further new observations are taken, etc. Exact significance levels are obtainable, by use of appropriate randomization models and special kinds of subtest statistics. Subtests are always included wherein the second and each following set is compared with the data for re-use, to investigate whether the data

continue to be from the same population. An additional subtest can be included for investigating whether the first set is a random sample. Unconditional tests can be obtained when ranks are used. Some applications to quality control are outlined. Author

N71-26126# Royal Aircraft Establishment, Farnborough (England).
PROBABLE QUEUE LENGTHS FOR MERGING EXAMPLE OF SECTION 8.2.4(c), APPENDIX J
D. I. Paddison *In its* Cabtrack Studies: Assessment of Autotaxi Urban Transport Systems Jan. 1969 p 79–81 (See N71-26116 14-34)
Copyright. Avail: NTIS

A numerical analysis of the demands on a London, England transportation system is presented. The analysis is based on queueing theory and results are expressed as probability of occurrence. Author

N71-26156# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
NUMERICAL RESULTS FOR SOBOLEV'S FUNCTION Q OF RADIATIVE TRANSFER
June Buell, Robert Kalaba, and Sueo Ueno Jun. 1970 25 p refs
(Grants GM-16197-01; GM-16437-01; NSF GF-294)
(TR-70-37) Avail: Issuing Activity

The invariant imbedding approach is used to transform the integral equation for the function Q into a Cauchy problem which is readily solved via modern digital or analog computers. Numerical results are presented in the form of tables and graphs, and a discussion of the accuracy attained is presented. Author

N71-26163# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
A METHOD OF CHARACTERISTICS FOR SYNTHESIS AND IDENTIFICATION OF DISTRIBUTED PARAMETER SYSTEMS
Anil Jain and Gerald Cohen Jun. 1970 50 p refs
(Grant GM-16197-02)
(TR-70-36) Avail: NTIS

The method of characteristics for distributed control problems is extended to synthesis and identification problems in control theory. This method could be useful in identification of distributed parameters in situations like blood flow through the aorta and freeway traffic flow. Author

N71-26205 Brown Univ., Providence, R.I.
ON THE STABILITY AND CONTROL OF PROCESSES DESCRIBED BY STOCHASTIC FUNCTIONAL DIFFERENTIAL EQUATIONS
Daniel Izhak Barnea (Ph.D. Thesis) 1969 151 p
Avail: Univ. Microfilms Order No. 70-8686

These processes serve as mathematical models for dynamical systems with time delays and memory where the rate of change depends on past state values of the system's trajectory as well as on the present state. A very realistic model is considered when time delays are introduced into the various sections of the feedback channel of a noisy linear system with noise corrupted linear observations. An optimal control is derived for a quadratic cost and a finite time interval. This control is a function of a finite dimensional sufficient statistic. Elementary stability investigations of deterministic and stochastic Functional Differential Equations (F.D.E.) were pursued because of the annoying difficulties met in the application of available Lyapunov techniques to F.D.E. A special method (involving the formulation of certain minimization problems) is developed and is shown to yield some new and quite sharp results. Dissert. Abstr.

N71-26276 Maryland Univ., College Park.
CONVERGENCE OF THE RESIDUAL FOR RITZ-GALERKIN APPROXIMATIONS
Arthur Brooke Stephens (Ph.D. Thesis) 1969 69 p
Avail: Univ. Microfilms Order No. 70-11643

In general for boundary value problems of the form Au = f the Ritz-Galerkin residual need not converge to 0 in the mean. The weak and strong convergence of the residual are related. It is proved that if the residual converges for one operator equation it converges for another type of related operator equation. Conditions on the coordinate functions are investigated which affect the convergence of the residual. Certain multiplicative inequalities are used to illustrate how the convergence of the residual affects the uniform and L sub p convergence of the Ritz-Galerkin approximations. The results are applied to coordinate functions that are trigonometric functions, polynomials, and spline functions. Dissert. Abstr.

N71-26386*# Texas A&M Univ., College Station. Inst. of Statistics.
CONFIDENCE REGIONS FOR VARIANCE RATIOS IN VARIANCE COMPONENTS MODELS
A. S. Al-Barhawe and H. O. Hartley Mar. 1971 67 p refs
(Grant NGR-44-001-095)
(NASA-CR-118654; TR-5) Avail: NTIS CSCL 12A

Methods for constructing confidence intervals for variance ratios in balanced experimental designs are reviewed. Wald's method is discussed in detail and compared to Hartley and Rao's method. Confidence limits for variance ratios are constructed in one-way, nested, and two-way classifications and balanced incomplete block designs. Two unbalanced designs are also considered and a confidence interval is constructed for a variance ratio in one-way classification with unequal numbers per sub class. An unbalanced nested classification with unequal levels of the secondary factor and unequal numbers of observations per secondary factor is discussed and confidence regions for variance ratios one and two are derived. J.M.

N71-26407 Brown Univ., Providence, R.I.
THE ASYMPTOTIC BEHAVIOR OF THE SOLUTION TO A NONLINEAR SYSTEM OF INTEGRODIFFERENTIAL EQUATIONS OCCURING IN REACTOR DYNAMICS
William Stanley Helliwell (Ph.D. Thesis) 1969 74 p
Avail: Univ. Microfilms Order No. 70-8733

Asymptotic behavior of solutions of nonlinear Volterra integral equations is obtained using functional analytic techniques. The theory is then applied to a system of equations describing the temperature and power output of a nuclear reactor. Dissert. Abstr.

N71-26429*# Stanford Univ., Calif. Information Systems Lab.
CONSIDERATION OF BIAS IN LINEAR ESTIMATION
David E. Stepner Oct. 1970 124 p refs Sponsored in part by NASA
(Contract F33615-67-C-1245)
(NASA-CR-118665; AD-715945; SU-SEL-70-071; TR-6304-5) Avail: NTIS CSCL 09D

The Kalman formulation of the minimum mean square linear estimation problem prescribes that the initial state x(0) be a random variable with known distribution and that x primed(0), the estimate of the initial state, is to be E braces x(0), the mean of that distribution. This report begins with the premise that x(0) is a random variable but with unknown distribution. The immediate result is that the initial state estimate cannot fail to be biased, unlike the Kalman estimate. Two examples are given which illustrate the fact that if one then insists upon zero bias at some later time, one cannot also simultaneously minimize error variance. It is proposed that the alternate performance criterion of minimizing an arbitrary sum of error variance and outer product of error mean be used and, starting from first principles, a necessary and sufficient

condition is derived for the optimal estimator. An estimator is found which satisfies this condition and an equivalent recursive form is obtained. It turns out that this form is exactly like the Kalman equations except for the interpretation of x primed(0) and the fact that the initial condition required for the Riccati equation is the arbitrary sum of the initial error covariance and the outer product of error mean. (Mean square error is just a special case of this more general presentation). This latter initial condition cannot be found exactly and, for the special case of x(0) treated as an unknown nonrandom parameter, three methods are presented for obtaining an approximate initializing value for the Riccati equation.
Author (GRA)

N71-26430*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ANALYSIS OF A CONTROL SYSTEM CONTAINING TWO NONLINEARITIES
S. M. Seltzer 30 Apr. 1971 14 p refs
(NASA-TM-X-64601) Avail: NTIS CSCL 12A

A control system containing two nonlinear elements may be analyzed in the parameter plane to determine the existence, stability, and values of amplitude and frequency of limit cycles. By using describing functions to represent the nonlinearities, the system characteristic equation may be obtained. Two adjustable parameters are selected, each containing one of the describing functions and possibly several control system gains. A correlation between these parameters and the roots of the characteristic equation is determined by mapping stability contours from the complex s-plane onto the chosen parameter plane. A relationship between the inputs to the two nonlinearities is determined next, and a locus representing the variation of the describing functions also is plotted on the parameter plane. If this locus and the stability contour associated with a pair of pure imaginary roots intersect, the existence and characteristics of a limit cycle are indicated. Particular emphasis is placed on organizing the equations so that they may be readily solved with a digital computer.
Author

N71-26438# Budapest Science Univ. (Hungary). Inst. for Theoretical Physics.
GHOST KILLING WITH SATELLITES
I. Montvay Jun. 1970 8 p refs
(ITP-278; NP-18543) Avail: AEC Depository Libraries

An iterative procedure is described for the elimination of ghosts and parity partners on a finite number of daughter trajectories in the generalized Veneziano model.
Author (NSA)

N71-26527# Royal Aircraft Establishment, Farnborough (England).
ON SOME DEVELOPMENTS IN THE STUDY OF PROCESSES FOR SOLVING ORDINARY DIFFERENTIAL EQUATIONS
R. H. Merson Aug. 1969 11 p refs
(RAE-TM-SPACE-126) Avail: NTIS

Developments in improved methods of solving sets of ordinary differential equations using a digital computer are presented. The systems described are: (1) basic expansion, (2) higher order method, and (3) modification of five stage process.
Author

N71-26564# Forsvarets Teletekniska Lab., Stockholm (Sweden).
THE USE OF STOCHASTIC PROCESSES IN THE ANALYSIS OF THE SECURITY OF A POWER SYSTEM [ANVAENDNING AV STOKASTISKA PROCESSER VID ANALYS AV DRIFTSAEKERHETEN HOS SYSTEM]
Hans Ebenfelt Jul. 1969 86 p refs In SWEDISH
(FTL-A-A08-9) Avail: NTIS

An heuristic exposition of the theory of Markov and semi-Markov processes is given with emphasis on those results which are of special interest in the construction of system models. The described methods should be viewed as a way of realizing dynamic systems models and thereby the effectiveness of systems.
Author

N71-26616# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
QUASILINEARIZATION AND STABILITY OF NON-LINEAR STOCHASTIC SYSTEMS
R. Bellman, T. T. Soong, and R. Vasudevan Apr. 1971 9 p refs
(Grants GM-16197-03; NSF GK-1834X)
(TR-71-16) Avail: Issuing Activity CSCL 12A

Application of quasilinearization is shown to lead to an explicit analytic representation for solutions of nonlinear stochastic differential or difference equations in terms of quadratures and the extremum operation. A nonlinear differential equation of the Riccati type is considered.
Author

N71-26617 Georgia Inst. of Tech., Atlanta.
A MOMENT TECHNIQUE FOR SUBOPTIMAL ADAPTIVE NONLINEAR FILTERING
Te-son Kuo (Ph.D. Thesis) 1970 127 p
Avail: Univ. Microfilms Order No. 70-12969

A moment algorithm is described for estimating the states of noisy linear, time-invariant discrete systems having nongaussian disturbances. The moment technique is combined with the reachable set concept in applying the Bayesian decision rule and the least mean-square error criterion. Formulas relating the moments of the observed data, the states, and the input signal are established. The suboptimal adaptive nonlinear filter algorithm is applied to zero-order, first-order, and second-order problems. After the basic algorithm is established for the zero-order problem, it is shown that the result is not seriously affected by a significant amount of correlation between the input signal and the measurement noise. The filter is applied to a class of zero-order nonadditive noise problems, a nonlinear first-order system by linearizing over the range of operation, and a time-varying first-order system by averaging the time-varying parameter over several sampling intervals.
Dissert. Abstr.

N71-26674* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METHOD FOR GENERATING ULTRA-PRECISE ANGLES Patent
Robert L. Appler, inventor (to NASA) Issued 2 Feb. 1971 4 p Filed 7 Aug. 1967 Cl. 350-285; Int. Cl. G01b11/27
(NASA-Case-XGS-04173; US-Patent-3,560,081; US-Patent-Appl-SN-658964) Avail: US Patent Office CSCL 12A

A method for generating ultra-precise angles employing a rotatably supported triangular prism and a fixed position light reflecting mirror is described. When the prism is in a reference position, a parallel return ray is reflected as a given ray of monochromatic light incident upon the prism. Upon rotation of the prism through a monitored angular displacement about an axis parallel to the prism refracting surfaces, there is generated an angle defined by the resultant angular displacement of the reflected return ray with respect to the incident ray; the angle thus generated being substantially smaller than the monitored angular displacement of the prism and significantly reducing any error introduced in determining the value of the generated angle due to error encountered in monitoring prism rotation.
Official Gazette of the U.S. Patent Office

N71-26675# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
A NOTE ON SAMPLE SOLUTIONS OF ORDINARY STOCHASTIC DIFFERENTIAL EQUATIONS

T. T. Soong Apr. 1971 6 p refs
(Grants GM-16197-03; NSF GK-1834X)
(TR-71-12) Avail: Issuing Activity

Stochastic sample solutions for ordinary stochastic differential equations are defined and used in the discussion of Langevin-type differential equations. The admissibility of this definition is discussed and more detailed results on the measurability properties of these sample solutions are presented. Author

N71-26676# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
REDUCTION OF DIMENSIONALITY FOR THE POTENTIAL EQUATION USING DYNAMIC PROGRAMMING
Edward Angel and Richard Bellman Mar. 1971 13 p refs
(Contract AT(11-1)-1113; Grant NSF GP-20423)
(USC-113-P-19-8; TR-71-13) Avail: NTIS

Dynamic programming and invariant imbedding for the analytic and computational treatment of the potential equation are considered. The high dimension of associated Riccati equations are overcome at the expense of increasing the number of one dimensional operations that are performed. The same method can be applied to many other types of partial differential equations. Author

N71-26677# University of Southern Calif., Los Angeles.
STATISTICAL ANALYSIS: A COMPUTER ORIENTED APPROACH, IV-1: THE ANALYSIS OF VARIANCE
S. R. Azen and A. A. Afifi (Calif. Univ., Los Angeles) May 1971 60 p refs
(Grant GM-16197-03)
(TR-71-14) Avail: Issuing Activity

The one-way analysis of variance is a technique for comparing k > or = to 2 means from k strata or subpopulations. In either case, the strata or subpopulations may be viewed as different levels of some basis for classification factors. The general problem involves several factors, each with more than one level. Underlying each problem is a specification of the assignment of each experimental unit to a particular combination of the levels of the factors under consideration, and the mathematical equation expressing each observation as a sum of a mean and an error term. The mean of each observation is expressed as the sum of an overall mean and an effect for each factor and for every combination of factors. The statistical problems involved are to estimate these effects and test hypotheses concerning them. Author

N71-26695# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
NOTES ON A SIMPLE INSPECTION SYSTEM
Shunji Osaki Apr. 1971 12 p refs
(Grant GM-16197-03)
(TR-71-5) Avail: Issuing Activity

In a simple system in which a unit is operative, the inspection for the system is made according to a specified distribution, and the unit can be replaced only on the inspection instant. The availability for the system is derived by using Markov renewal processes. Some numerical examples of the availability are finally presented. Author

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N71-25602# Naval Postgraduate School, Monterey, Calif.
DYNAMICAL MECHANISMS PRODUCING LARGE-SCALE TRANSPORT OF ATMOSPHERIC TRACE SUBSTANCES Final Report, Oct. 1969 – Sep. 1970
J. D. Mahlman Oct. 1970 180 p refs
(AD-719895; NPS-51MZ70101A) Avail: NTIS CSCL 4/2

Contents: On the maintenance of the polar front jet stream: A numerical simulation of the advective and diffusive transfer of trace substances in the stratosphere; Numerical calculations of stratospheric ozone transport; and An overview of various research efforts and techniques employed for investigation of trace substance transport in the atmosphere. GRA

N71-25676# Weather Wing (1st), San Francisco, Calif. 96553
CEILING AND VISIBILITY ATLAS FOR SOUTHEAST ASIA (5000 AND 5)
May 1970 104 p Supersedes AD-484091
(AD-707494; Rept-1WW-SS-105-12/2-Rev) Avail: NTIS CSCL 4/2

Isoline maps (scale 1:9,000,000) of Southeast Asia showing the distribution of percent frequency of occurrence of ceilings plus or minus or less than 5000 ft and visibility plus or minus or less than 5 miles at 0100, 0400, 0700, 1000, 1300, 1600, 1900, and 2200 LST are presented. This publication supersedes the 'Ceiling/Visibility Atlas for Southeast Asia (5000 and 5). GRA

N71-25779# National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.
SOME RESULTS OF SINGLE CLOUD PYROTECHNIC SEEDING IN FLORIDA, 1970
William L. Woodley, Joanne Simpson, Alan H. Miller, Steven Mac Kay, Richard Williamson, et al Nov. 1970 107 p refs
(COM-71-00184; NOAA-ERLTM-AOML-10) Avail: NTIS

Five aircraft participated including one for seeding photogrammetry and in-cloud measurements; one for in-cloud measurements near cloud base; one for mid-levels; one for following top heights and occasional penetrations; and one for dropsondes and high-level observations. The cloud growth and rainfall results of the program are reported. The rainfall analyses were made with a calibrated 10-cm radar, by the method developed and tested for the 1968 data. Significance is better than five percent for the whole cloud lifetimes for the 1970 data. Intraday comparisons were made comparing seeded and control clouds on the same day. The possible inaccuracies in the radar-rainfall measurements are discussed, together with the analysis problems encountered. Author (GRA)

N71-25782*# National Aeronautics and Space Administration, Washington, D.C.
WEATHER IN MOTION
1970 8 p
(NASA-EP-79) Avail: SOD $0.50; NTIS CSCL 04B

Meteorological satellites and cloud photography are summarized briefly. The ATS 3 satellite and it's camera are described including the photographic display and picture formation of earth shadow; cloud formation, decay, and motion; and sun glitter. The meteorological benefits from the use of earth synchronous satellites are outlined including severe storm detection, remote sensing of atmospheric winds, and global measurements. J.M.

N71-25791# Federal Scientific Corp., New York.
PROGRAM FOR ON LINE MONITORING AND ANALYSIS OF METEOROLOGICAL DATA Final Technical Report
Mark R. Weiss Jan. 1971 38 p
(Contract F30602-69-C-0015)
(AD-720825; FSC-T-1/169; RADC-TR-71-16) Avail: NTIS CSCL 4/2

In support of the In-House Laser Propagation Program at RADCs SCOPE Facility, a computer program was developed to increase the on-site analysis capabilities of experimental optical and

meteorological parameters. The program utilizes an A/D converter and P-D-P8 computer. It accepts teletype inputs to establish sampling rate and averaging time; then computes and outputs RMS signal levels and amplitude histograms of the sampled parameter. The program is limited by the conversion time and sample rate which established the accuracies of the measurement.
Author (GRA)

N71-25810# Osservatorio Ticinese, Locarno-Monti (Switzerland).
ON THE QUANTITATIVE DETERMINATION OF PRECIPITATION BY A RADAR Final Report, Feb. 1962 - Oct. 1968
J. Joss, Karin Schram, J. C. Thams, and A. Waldvogel 1970 42 p refs *Its* Wissenschaftliche Mitteilung-36
(Contract AF 61(052)-550)
(AD-719878; AFCRL-70-0663) Avail: NTIS CSCL 4/2

Measurements of radar reflectivity, rainfall rate and drop-size distribution were made for three classes of rain type: drizzle, uniform steady rain, and thunderstorms. Power-law relationships of the type a(R to the b power) where Z is radar reflectivity factor, R is rain intensity, and a and b are constants, were found for the three classes of rain. For the measurement of daily rainfall amounts exceeding 10 mm, these relationships produced a standard error of estimate of plus or minus 13%. For the same data, use of a single Z-R relation of all types of rain gave a standard error of plus or minus 28%.
Author (GRA)

N71-25823# Westinghouse Research Labs., Pittsburgh, Pa.
A COMPARISON OF NATURAL LIGHTNING AND THE LONG LABORATORY SPARK WITH APPLICATION TO LIGHTNING TESTING Final Report
Martin A. Uman Aug. 1970 88 p refs
(Contracts DOT-FA66NF-AP-15; Nonr 4838(00))
(FAA-DS-69-16; FAA-NA-69-27) Avail: NTIS

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2. TEMPERATURE AND ELECTRON DENSITY IN LONG AIR SPARKS R. E. Orville, M. A. Uman, and A. M. Sletten p 895-896 refs (See N71-25825 14-20)

3. ACOUSTIC OUTPUT OF A LONG SPARK G. A. Dawson, C. N. Richards, E. P. Krider and M. A. Uman p 815-816 refs (See N71-25826 14-23)

4. PEAK POWER AND ENERGY DISSIPATION IN A SINGLE-STROKE LIGHTNING FLASH E. P. Krider, G. A. Dawson, and M. A. Uman (NASA, Wash., D.C.) 6 p refs (See N71-25827 14-20)

5. A HIGH-SPEED TIME-RESOLVED SPECTROSCOPIC STUDY OF THE LIGHTNING RETURN STROKE, PARTS 1, 2, 3 R. E. Orville p 827-856 refs (See N71-25828 14-20)

6. DETERMINATION OF LIGHTNING TEMPERATURE M. A. Uman p 949-957 refs (See N71-25829 14-20)

7. TIME INTERVAL BETWEEN LIGHTNING STROKES AND THE INITIATION OF DART LEADERS M. A. Uman and R. E. Voshall p 499-506 refs (See N71-25830 14-20)

N71-25824# Westinghouse Research Labs., Pittsburgh, Pa.
A COMPARISON OF NATURAL LIGHTNING AND THE LONG LABORATORY SPARK WITH APPLICATION TO LIGHTNING TESTING: INTRODUCTION
Martin A. Uman *In its* A Comparison of Nat. Lightning and the Long Lab. Spark with Appl. to Lightning Testing Aug. 1970 13 p refs (See N71-25823 14-20)
Avail: NTIS

The validity of the use of laboratory sparks in testing for lightning hazards is discussed. The following parameters of lightning and of the laboratory spark are considered of primary importance: (1) the maximum rate of change of electrical current, (2) the temporal characteristics of the temperature of the discharge channel, and (3) the shock wave generated by the expanding discharge channel in its initial phase.
Author

N71-25825# Westinghouse Research Labs., Pittsburgh, Pa.
TEMPERATURE AND ELECTRON DENSITY IN LONG AIR SPARKS
R. E. Orville (Arizona Univ. - Tucson), M. A. Uman, and A. M. Sletten *In its* A Comparison of Nat. Lightning and the Long Lab. Spark with Appl. to Lightning Testing Aug. 1970 2 p refs Repr. from J. Appl. Phys., v. 38, no. 2, Feb. 1967 p 895-896 refs (See N71-25823 14-20)
Avail: NTIS

A spectroscopic analysis of long air sparks produced by laboratory equipment is presented. Five meter long air discharges were created between a negative rod and a grounded plane with a 6.4 Megavolt impulse generator. The spectrometer consisted of a transmission grating and associated optics coupled to a high speed camera. A six centimeter length of the spark channel was isolated for observation. Spark temperature was calculated from the relative spectral line intensities and electron density from the Stark broadening of certain spectral lines.
Author

N71-25827*# National Aeronautics and Space Administration, Washington, D.C.
PEAK POWER AND ENERGY DISSIPATION IN A SINGLE STROKE LIGHTNING FLASH
E. P. Krider, G. A. Dawson (Arizona Univ., Tucson), and M. A. Uman (Westinghouse Res. Labs., Pittsburgh, Pa.) *In* Westinghouse Res. Labs. A Comparison of Nat. Lightning and the Long Lab. Spark with Appl. to Lightning Testing Aug. 1970 6 p Repr. from J. Geophys. Res., v. 73, no. 10, 15 May 1968 p 3335-3339 refs (See N71-25823 14-20)
(NASA-TM-X-67182) Avail: NTIS CSCL 04B

A recent study comparing the acoustic output of a long air spark and lightning required a reliable value for the average energy dissipated per unit length in a single lightning stroke. Previous estimates of this energy have depended on a knowledge of the average quantity of charge transferred per stroke and an educated guess at the potential difference between cloud and ground. In the present study, the peak radiant power and the total radiant energy emitted within a given spectral region by a single-stroke lightning flash are compared with those given off by a long spark whose electrical power and energy inputs are known with fair accuracy.
Author

N71-25828# Westinghouse Research Labs., Pittsburgh, Pa.
A HIGH SPEED TIME RESOLVED SPECTROSCOPIC STUDY OF THE LIGHTNING RETURN STROKE, PARTS 1, 2, 3
Richard E. Orville *In its* A comparison of Nat. Lightning and the Long Lab. Spark with Appl. to Lightning Testing Aug. 1970 31 p refs Repr. from J. Atmos. Sci., v. 25, no. 5, Sep. 1968 p 827-856 Sponsored in part by ONR (See N71-25823 14-20)
Avail: NTIS

Time-resolved spectra of lightning return strokes between the cloud and the ground are presented. A quantitative analysis of the time-resolved spectra of return lightning strokes is described. A model of the lightning return stroke is developed based on time-resolved spectra, the quantitative analysis of the stroke, and tables for the composition of dry air in thermodynamic equilibrium.
Author

N71-25829# Westinghouse Research Labs., Pittsburgh, Pa.
DETERMINATION OF LIGHTNING TEMPERATURE

Martin A. Uman *In its* A Comparison of Nat. Lightning and the Long Lab. Spark with Appl. to Lightning Testing Aug. 1970 10 p refs Repr. from J. Geophys. Res., v. 74, no. 4, 15 Feb. 1969 p 949-957 (See N71-25823 14-20)
Avail: NTIS

The assumptions on return-stroke channel opacity, temperature profile, and energy-state distribution that have been used in lightning temperature calculations are examined. It is shown that the assumptions used are probably valid, except perhaps during the initial few microseconds of the discharge, and that a reasonable approximation to local thermodynamic equilibrium exists within the return-stroke channel. Author

N71-25830# Westinghouse Research Labs., Pittsburgh, Pa.
TIME INTERVAL BETWEEN LIGHTNING STROKES AND THE INITIATION OF DART LEADERS
Martin A. Uman and Roy E. Voshall *In its* A Comparison of Nat. Lightning and the Long Lab. Spark with Appl. to Lightning Testing Aug. 1970 11 p refs Repr. from J. Geophys. Res., v. 73, no. 2, 15 Jan. 1968 p 497-506 (See N71-25823 14-20)
Avail: NTIS

The temperature decay of a lightning channel during the interstroke period is determined theoretically. It is shown that, in the absence of input energy to the channel, the channel temperature will decay sufficiently slowly so that conditions conducive to the initiation and propagation of a dart leader will exist in the channel after a typical interstroke period of 40 msec. The calculations indicate that the lightning channel radius during the latter stages of a lightning stroke is of the order of centimeters. A mechanism is suggested to explain the phenomenon of bead lightning and to account for the observed long-lasting luminosity occurring at certain points on the normal discharge channel. Author

N71-25879# Environmental Technical Applications Center (Air Force), Washington, D.C.
US NAVAL WEATHER SERVICE WORLD WIDE AIRFIELD SUMMARIES. VOLUME 10: PART 2: EUROPE (LOW COUNTRIES AND BRITISH ISLES)
Apr. 1971 537 p refs
(AD-719908) Avail: NTIS CSCL 4/2

The volume is part of a series of compilations which is world-wide in scope. It consists of climatological summaries for selected airfields and for the climatic areas in which they are located. When complete, the series will include data for approximately 3000 stations which includes Europe, low countries and British Isles. Author (GRA)

N71-25880# Environmental Technical Applications Center (Air Force), Washington, D.C.
US NAVAL WEATHER SERVICE WORLD WIDE AIRFIELD SUMMARIES. VOLUME 10: PART 1: EUROPE (SCANDINAVIA AND NORTHERN EUROPE)
Apr. 1971 516 p refs
(AD-719907) Avail: NTIS HC $6.00/MF $0.95 CSCL 4/2

The area volume is part of a series of compilations which is world-wide in scope. It consists of climatological summaries for selected airfields and for the climatic areas in which they are located. When complete, the series will include data for approximately 3000 stations. Author (GRA)

N71-25884+ Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 115, NO. 5: RESULTS OF THE ASCENTS OF THE RADIOSONDE STATION, BERLIN-TEMPELHOF, OF THE INSTITUT FUER METEOROLOGIE UND GEOPHYSIK OF THE FREIE UNIVERSITAET BERLIN, MAY 1970. DAILY MEASUREMENTS, MONTHLY COMPILATION AND CLIMATOLOGICAL VALUES AS WELL AS RESULTS OF SPECIAL ASCENTS [METEOROLOGISCHE ABHANDLUNGEN. BAND 115, HEFT 5: ERGEBNISSE DER AUFSTIEGE DER RADIOSONDENSTATION, BERLIN-TEMPELHOF, DES INSTITUTS FUER METEOROLOGIE UND GEOPHYSIK DER FRIEN UNIVERSITAET BERLIN IM JAHRE 1970, MAI. TAEGLICHE MESSRESULTATE, MONATLICHE BEARBEITUNG UND KLIMATOLOGISCHE WERTE, SOWIE MESSERGEBNISSE VO SPEZIALAUFSTIEGEN]
Eugen Pantzke, Richard Scherhag et al 1970 188 p In GERMAN; ENGLISH summary
Avail: NTIS CSCL 04B

The detailed results of the radiosonde ascents performed by the aerological station of the Institute of Meteorology and Geophysics for the University of Berlin are presented. Using these data, monthly time cross sections of the averaged temperature and the zonal and meridonal wind components in heights above 30 km were constructed. Extreme and mean values of the temperature, pressure, geopotential, wind data, refractivity, pseudopotential temperature, and velocity of sound were extracted for all standard pressure surfaces, several height levels, the tropopause, and the freezing level. The data of the ozone-ascents were given in tabular and graphical form. Author

N71-26027+ Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 112, NO. 11: RESULTS OF THE SYNOPTIC SERVICE DURING 1970. DAILY WEATHER MAPS (GROUND, 500 mb, 300 mb) AND BRIEF SCIENTIFIC ARTICLES, NOVEMBER [METEOROLOGISCHE ABHANDLUNGEN. BAND 112, HEFT 11. ERGEBNISSE DES SYNOPTISCHEN DIENSTES IM JAHRE 1970. TAEGLICHE WETTERKARTEN (BODEN 500 mb, 300 mb), UND KLEINERE WISSENSCHAFTLICHE AUF SAETZE, NOVEMBER]
Manfred Geb, Leopold Klauser, Richard Scherhag et al 1970 244 p refs In GERMAN
Avail: NTIS

Synoptic meteorological charts of climatological averages in Berlin-Dahlem for November and the fall of 1970 are presented including West Berlin temperature-precipitation relationships and radioactivity. World weather conditions are also summarized for 1969 and 1970. Brief reports are given including a November 1970 weather forecast for middle Europe, satellite photographs and cold fronts, meteorology and economy, and the 21st International Astronautical Congress held on 10 October 1970 in Constance, West Germany. J.M.

N71-26077+ Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 113, NO. 3: BERLIN READINGS; DIGITAL AND ANALOG RESULTS FROM THE CENTRAL MEASUREMENT FACILITY AND FROM OTHER INSTRUMENTS FOR 1970, PART 3 Quarterly Report, 1 Jul.-30 Sep. 1970 [METEOROLOGISCHE ABHANDLUNGEN. BAND 113, HEFT 3: BERLINER MESSWERTE; DIGITALE UND ANALOGE ERGEBNISSE DER ZENTRALEN MESSWERTREGISTRIERANLAGE UND WEITERER INSTRUMENTE FUER DAS JAHR 1970, TEIL 3, 3. VIERTELJAHR]
Richard Scherhag, Erich Wedler et al 1970 380 p refs In GERMAN *Its* Berlin Readings No. 182-273
(QR-3-Pt-3) Avail: NTIS HC $6.00/MF $0.95 CSCL 04B

The detailed results of meteorological measurements obtained mainly at the central registration facility in Berlin are presented. Graphs and data tables for the period July 1 through September 30 contain values for atmospheric pressure, wind velocity and direction, atmospheric temperature, dew point, relative atmospheric

humidity, precipitation, earth surface temperature, solar radiation, sky brightness, and radio interference. G.G.

N71-26105# Army Electronics Command, Fort Monmouth, N.J.
DIRECTIONAL ION ANEMOMETER
Andrew Petriw Dec. 1970 40 p refs
(AD-720573; ECOM-3379) Avail: NTIS CSCL 4/2

An improved direction-sensitive steady-state ion current type of anemometer has been devised to meet the need for a field instrument capable of measuring the direction angle, elevation angle, and speed of wind down to 5 centimeters per second (approximately 0.11 miles per hour). An analysis of the operating principles of this ion anemometer has been conducted to ascertain the feasibility of the proposed instrument and to help achieve an optimum design in the shortest possible time. The results of this analysis and the important design factors, which determine its sensitivity, linearity, stability, and angular response characteristic, are described. Author (GRA)

N71-26281# Oklahoma State Univ., Stillwater. School of Electrical Engineering.
A CENTER FOR THE DESCRIPTION OF ENVIRONMENTAL CONDITIONS: WEATHER PHENOMENA Annual Progressreport, Oct. 1969 – 30 Sep. 1970
William L. Hughes, Paul A. McCollum, K. Shanmugam, and Emmett J. Pybus Dec. 1970 160 p
(Contract DAAB07-68-C-0083)
(AD-720769; OSU-WP-70-I-12; ECOM-0083-12; APR-3) Avail: NTIS CSCL 4/1

The Oklahoma State University Themis Weather Phenomena Project sampled severe storm sferics in the vicinity of central Oklahoma, at Black Hills, South Dakota; Greely, Colorado and Las Cruces - White Sands, New Mexico. The doctoral dissertations have been written using Themis sferic data. The first paper derived a theory of computer learning in which the teacher is considered to be both perfect and another, more general case, where the teacher is imperfect. The second paper derived a theoretical computer model for describing various lightning strokes. The third paper describes the spectral power density content of the sampled sferics. Sferic stroke rate is shown to strongly correlate with the rate of growth of a convective cell. Author (GRA)

N71-26308# Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla.
SEASONAL VARIATIONS OF THE INTER-TROPICAL CONVERGENCE ZONE STUDIES WITH AN INTERACTING ATMOSPHERE AND OCEAN MODEL Final Report, Nov. 1967 – Jan. 1971
Arthur C. Pike Jan. 1971 51 p refs
(Contract F19628-68-C-0144)
(AD-720266; AFCRL-71-0067) Avail: NTIS CSCL 4/2

A simple, four-level primitive-equation model of a zonally-symmetric tropical atmosphere has been combined with a two-layer model of the upper tropical ocean in order to predict three years of inter-tropical convergence zone (ITCZ) behavior under the influence of seasonally-variable solar heating of the sea. A cold equatorial surface develops on account of oceanic upwelling and vertical mixing; a single ITCZ establishes itself, off the equator, over the surface temperature maximum in the warmer hemisphere. This convergence zone migrates quickly between hemispheres, with only a minor lag, when the progress of the seasons causes the hemispheric surface temperature asymmetry to reverse every half year. Such behavior is qualitatively in accord with that of the updraft branch of the mean tropical Hadley circulation in the real atmosphere. The lag of maximum sub-equatorial sea surface temperature behind the overhead sun of late summer is computed to be about nine weeks. Author (GRA)

N71-26820# Texas A&M Research Foundation, College Station. Dept. of Oceanography.
PREDICTION OF ENVIRONMENTAL PARAMETERS, VOLUME 2 Annual Report, 20 Oct. 1969–20 Oct. 1970
R. A. Clark, W. H. Clayton, F. S. Darby, D. R. Greene, J. F. Paris et al Mar. 1971 126 p refs
(Contract DAAB07-68-C-0073; Proj. Themis)
(AD-720218; A/M-Ref-70-16-F-Vol-2; ECOM-0073-4-Vol-2; AR-3) Avail: NTIS CSCL 4/2

During the third year, Project Themis activities at Texas A and M University have been concentrated in six primary research areas: cumulus cloud dynamics, analog modeling of the frictional boundary layer, design of a facility for direct measurement of Reynolds stresses, modification of cloud systems associated with easterly perturbations as they move over areas of differing water temperatures, mesoscale analyses based on radar and micrometeorological measurements, and mesoscale air-sea interaction. Author (GRA)

N71-26821*# Allied Research Associates, Inc., Concord, Mass.
THE APPLICATIONS TECHNOLOGY SATELLITES METEOROLOGICAL DATA CATALOG, VOLUME 5 Final Catalog, 1 Aug. 1969 – 25 May 1970
Oct. 1970 462 p refs
(Contract NAS5-10343; Proj. ATS)
(NASA-CR-118653) Avail: NTIS CSCL 04B

Meteorological data obtained from ATS-3 are cataloged. The material is presented in separate sections that include: (1) data applications examples, (2) orbital data, (3) Multicolor Spin Scan Cloud Camera (MSSCC) meteorological data, and (4) MSSCC tape listings. In addition, a 28 month summary of ATS-1 operations is given. D.L.G.

N71-26892*# Space Data Corp., Phoenix, Ariz.
STUDY OF 30 KM TO 200 KM METEOROLOGICAL ROCKET SOUNDING SYSTEMS. VOLUME 2: RECENT ADVANCEMENTS
Bruce Bollermann Washington NASA May 1971 221 p refs
(Contract NAS8-24386)
(NASA-CR-1790) Avail: NTIS CSCL 04B

Rocketsonde temperature measurements were improved. The passive falling-sphere density measurements are being improved, and drag coefficient data are being refined. Larger Starutes have been developed along with lighter telemetry packages to reduce the rocketsonde descent velocities to a ballistic coefficient on the order of 0.016 lb/sq ft. Further investigations were conducted for the Stokes flow decelerator. The AN/GMD-4 telemetry system was successfully used to supply complete tracking data for transponder rocketsondes. A transponder instrument was successfully flown with the Super Loki vehicle in a large diameter Dart to an altitude of over 75 km. Efforts continued for the Army RDT&E rocket. The Astrobee D vehicle successfully flown with heavy payloads. To improve the precision of the passive falling-sphere density measurements and eliminate the drag coefficient and vertical wind problems, a low-cost pitot probe system is proposed. This system employs small Super Loki rocket motors in a low-cost two-stage vehicle configuration and AN/GMD-2 telemetry and tracking instrumentation for data acquisition. A vibrating diaphram pressure transducer is proposed as the sensor to measure ram impact pressure at the nose of the rapidly ascending vehicle from 50 km to 120 km altitudes. Author

N71-26720# Army Foreign Science and Technology Center, Charlottesville, Va.
A COMPARISON OF THE RESULTS OF RADAR INVESTIGATIONS OF CONVECTIVE CLOUDS WITH THE MECHANISM OF PRECIPITATION FORMATION [SOPOSTAVLENIE REZULTATOV RADIYOLOKATSIONNYKH

ISSLEDOVANII KONVEKTIVNYKH OBLAKOV S MEKHANIZMOM OBRAZOVANIYA OSADKOV]
V. F. Lapcheva 18 Feb. 1971 25 p refs Transl. into ENGLISH from the Russian
(AD-720731; FSTC-HT-23-1109-70) Avail: NTIS CSCL 4/2

An attempt is made at comparing the results of radar investigations of convective clouds and precipitation obtained in high-mountain (2,200 m above sea level) and foothill (500–700 m above sea level) regions of the Northern Caucasus and the mechanism of formation of shower precipitation and hail. The parameters of the radar characteristics of zones of reflection from rain and hail clouds and the degree of radar reflectivity are presented. Profiles of the zones of reflection from hail clouds and profiles of the change in vertical radar reflectivity are constructed.
Author

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N71-25805# National Aviation Facilities Experimental Center, Atlantic City, N.J.
DEVELOPMENT AND EVALUATION OF A DOUBLE SIDEBAND DOPPLER VOR SYSTEM WITH HIGH LEVEL REFERENCE MODULATION Final Report, Nov. 1962–May 1971
Virgil E. Willey Jun. 1971 176 p refs
(FAA-NA-71-36; FAA-RD-71-25) Avail: NTIS

The development and evaluation of an improved Doppler VOR System is described which will provide improvement of receiver compatibility with existing receiving equipment and reduction of station bearing error with some additional reduction of siting effects and a reduction of counterpoise size. A new method of providing the 30 Hz amplitude modulation of the carrier, applicable to either the present Single Sideband or the Double Sideband Doppler VOR System for increased carrier power is also described.
Author

N71-25775# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
THE DEVELOPMENT OF LONG-RANGE HYPERBOLIC NAVIGATION IN THE UNITED STATES
J. A. Pierce and R. H. Woodward Feb. 1971 35 p refs
(Contract N00014-67-A-0298-0008)
(AD-719904; TR-620) Avail: NTIS CSCL 17/7

The paper is derived primarily from the personal recollections of the authors, spanning the entire period in which navigation by the timing of radio signals has developed in this country. If there is a lesson to be learned from this fragmentary history, it is that the pressure of navigational requirements has always demanded more than our knowledge of the facts of radio wave propagation could supply. The systems reviewed have been constructed on the basis of, at best, empirical data or, at worst, guesses. Under these circumstances, new discoveries have, from time to time, brought forth new methods and new systems, while habit has tended to keep the older techniques in operation. These forces provide a partial explanation of a perhaps unfortunate proliferation, some of which might have been avoided had research provided sounder theories and more precise data in advance of the demand for navigation aids having larger service areas and improved accuracy.
Author (GRA)

N71-26197# Iowa State Univ. of Science and Technology Technology, Ames. Engineering Research Inst.
ERROR ANALYSIS OF AN INTEGRATED INERTIAL/DOPPLER-SATELLITE SYSTEM WITH CONTINUOUS AND MULTIPLE SATELLITE COVERAGE
D. J. Winger and R. G. Brown Jan. 1971 137 p
(Contract N00014-68-A-0162)
(AD-720395; ERI-94900) Avail: NTIS CSCL 17/7

The study investigates the accuracy of an integrated navigation system in which a modest quality airborne inertial navigation system is coupled with an extensive system of (Doppler) navigation satellite. The two systems are integrated in an optimal fashion by using the delayed-state Kalman filter. The performance of the integrated system was evaluated by conducting variance analyses on a number of computer-simulated flights in which an aircraft was assumed to be equipped with both navigation systems. Three hypothetical Doppler-satellite configurations were considered in these studies; all of these configurations provided sufficient satellite coverage to enable continuous Doppler measurements from two satellites to be used for the Kalman filter input. A Doppler satellite generally provides better navigation information in its along-track direction than its crosstrack direction, and this is reflected in the integrated system by an imbalance in the quality of the estimates of the two level channel errors. Three satellite altitudes were considered and it was found that the accuracy of the integrated system degrades with increased satellite altitude. The variation of the quality of the inertial system was found to have a lesser effect on the resultant performance than did the quality of satellite coverage.
Author (GRA)

N71-26198*# National Aeronautics and Space Administration, Washington, D.C.
SPACECRAFT ATTITUDE CONTROL DURING THRUSTING MANEUVERS: SPACE VEHICLE DESIGN CRITERIA (GUIDANCE AND CONTROL)
Feb. 1971 51 p refs
(NASA-SP-8059) Avail: NTIS CSCL 22B

Attitude control problems associated with thrusting maneuvers are reviewed, and design criteria and recommended practices for avoiding such problems are presented. Three types of attitude control systems are considered; spin stabilization, passive control, and active closed-loop control.
D.L.G.

N71-26347# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BASIS OF THE MODEL OF AN IDEAL SPATIAL NEWTONMETER (ACCELEROMETER) IN THE THEORY OF INERTIAL NAVIGATION
V. D. Andreev et al 31 Dec. 1970 28 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Izv., Mekh. Tverd. Tela (Moscow), no. 6, 1969 p 15–25
(AD-720381; FTD-MT-24-303-70) Avail: NTIS CSCL 17/7

The model of an ideal spatial Newtonmeter (accelerometer) set on a moving object is examined. The relationship of this model and the combination of three real single-component (linear) Newtonmeters with noncoplanar axes of sensitivity in the system of inertial navigation is analyzed.
GRA

N71-26401# Ohio Univ., Athens. Dept. of Electrical Engineering.
ALL WEATHER, LOW-LEVEL NAVIGATION Semiannual Report, 10 Apr.–10 Oct. 1970
Jan. 1971 78 p refs
(Contract DAAB07-68-C-0084)
(AD-720214; ECOM-0084-2; SAR-2) Avail: NTIS CSCL 17/7

The results of the successful, initial flight experiments and measurements involving the tuned radio frequency receiver and the maximum likelihood phase estimator of the all-weather, low-level navigation system are given. At low level, 80 miles from the transmitter, 10 degrees (100 feet at 283 KHz) of phase resolution were obtained with received signal levels less than 0.1 microvolt. Short range (4 miles) ground based measurements showed

repeatability of one degree (10 feet at 263 KHz) for high received SNR conditions. A digital flight director design has been completed and indications from simulation studies are that it will provide increased capability to minimize error off-course without gyro feedback. Work has been done on programming the SPC-12 for airborne computations. This computer will be used with the receiving components to provide for a complete flyable system. All work is now converging on the goal of providing the government with a flying model which can be operated independent of its creators. With this model the efficacy of a low-level navigation system can be further evaluated. This report also discusses techniques developed for lane counting, narrow band filtering, receiver blanking to minimize spherics effects, frequency synthesis, low-frequency-beacon phase stability measurements and man-machine system considerations. Author (GRA)

N71-26593# Forsvarets Forskningsanstalt, Stockholm (Sweden). Andelning 3.
INTERNATIONAL SYMPOSIUM ON MARITIME NAVIGATION, SEPTEMBER 1969
Torsten Linell Nov. 1969 6 p Conf. held at Sandefjord, Norway, 24 – 26 Sep. 1969 Partly in SWEDISH, partly in ENGLISH
(FOA-3-C-3615-65) Avail: NTIS

Reviewed are lectures held at a symposium on maritime navigation. Considered are radio and satellite navigation systems and the developments of pertinent equipments and concepts for use in the merchant marine. Control and surveillance methods for safety of shipping in harbors and waterways are emphasized. G.G.

N71-26713*# General Electric Co., Schenectady, N.Y. Corporate Research and Development.
ATS RANGING AND POSITION FIXING EXPERIMENTS
Progress Report, 1 Nov. 1970 - 31 Jan. 1971
31 Jan. 1971 25 p refs
(Contract NAS5-11634)
(NASA-CR-118648; S-71-1024) Avail: NTIS CSCL 17G

Ranging tests were conducted using transponders at Shannon, Ireland; Reykjavik, Iceland; Gander, Newfoundland; Buenos Aires, Argentina; and Seattle, Washington. The effects of sea reflection multipath and the ability to track two aircraft relative to each other were investigated by comparing two-satellite position fixes with precision radar fixes for two aircraft flying at 5000 and 20,000 feet over the Atlantic Ocean off the coast of New Jersey and over land within range of the EAIR precision radar at Atlantic City. Synoptic measurements of the ionosphere were made at intervals throughout each day of a four-day period using the transponders at Shannon, Gander, Schenectady, and Seattle, and continuously over a 24-hour period with transponders at Gander, Reykjavik, Schenectady, and Thule. Measurements of ranging precision to ATS 1, which is below 2 deg elevation angle, were conducted during sunrise along the ray path in the ionosphere. Synoptic data were collected during four days following a solar flare, and range measurements were made from ATS 3 to Shannon, Gander, Schenectady, and Seattle throughout each day. No effects of the solar flare were apparent. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N71-25650# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
[SNAP-23A PROJECT, ADVANCED TERRESTRIAL RADIOISOTOPE POWER SYSTEMS] Final Report, 1 Mar. - 30 Jun. 1970
Nov. 1970 22 p refs
(Contract AT(30-1)-4182)
(WANL-4182-3) Avail: NTIS

Efforts devoted to design of the final Advanced Prototype System are summarized. Results of principal tests and analyses performed in support of the design are included along with results of safety reviews. NSA

N71-25684# WADCO Corp., Richland, Wash. Hanford Engineering Development Lab.
APPROACHES TO REACTOR SAFETY
P. L. Hofmann and R. E. Peterson Oct. 1970 35 p refs Presented at Meeting on Educ. and Res. in the Nucl. Fuel Cycle, Norman, Okla., 5 – 7 Oct. 1970
(Contract AT(45-1)-2170)
(WHAN-SA-43; CONF-701035-2) Avail: NTIS

The two basic approaches to reactor safety for water cooled reactors are: (1) reliance on accident prevention features and (2) reliance on consequence limiting features. These approaches are summarized and compared with the similar procedures used to treat liquid-metal-cooled fast breeder reactor safety questions. NSA

N71-25690# Argonne National Lab., Ill.
POSTIRRADIATION EXAMINATION OF TANTALUM CLADDING FROM PHOTONEUTRON STARTUP SOURCES FOR EBR-2
R. V. Strain, D. C. Cutforth, and V. G. Eschen Sep. 1970 28 p refs
(Contract W-31-109-eng-38)
(ANL/EBR-31) Avail: NTIS

The tantalum cladding from EBR-2 antimony-beryllium photoneutron startup sources was examined for evidence of corrosion and changes in physical properties. These sources were exposed to a 4-gpm flow of the EBR-2 primary-system sodium during their residence in the reactor. A tantalum-clad source irradiated to a total peak fluence of about 3.4 × 10 to the 22nd power nvt was examined most thoroughly. Optical metallographic examination revealed minor pitting at the outside surface of the cladding but no evidence of serious corrosion or other microstructural changes. Chemical analysis indicated an increase of 709 ppm oxygen, 98 ppm nitrogen, and 11 ppm hydrogen in the irradiated cladding. Changes in density of 2% (maximum) and changes in microhardness as great as 230 DPH were also observed. Author (NSA)

N71-25691# WADCO Corp., Richland, Wash.
NEW CANDIDATE LMFBR CLADDING ALLOY
J. J. Leidler 13 Nov. 1970 17 p refs Presented at the Meeting of the Am. Nucl. Soc., Washington, D.C.
(Contract AT(45-1)-2170)
(WHAN-SA-8; CONF-701102-12) Avail: NTIS

Properties of thermomechanically treated type 348 SST for LMFBR cladding applications are reviewed. It is noted that suitable treatment of this material produces NbC precipitation at dislocations and stacking faults which results in improved elevated-temperature mechanical properties. A high concentration of sinks and traps for point defects are found in the 348 microstructure. NSA

N71-25701# WADCO Corp., Richland, Wash.
IN CORE, SELF POWERED FAST NEUTRON FLUX MONITORS
J. W. Upton, Jr., D. P. Brown, and W. G. Spear 4 Aug. 1970 9 p Presented at the Am. Nucl. Soc. Power Div. Topical Meeting, Williamsburg, Va., 1 – 3 Sep. 1970

(Contract AT(45-1)-2170)
(WHAN-SA-23; CONF-700804-5) Avail: NTIS

The development of self powered fast neutron detectors for use in reactor cores is discussed. The detector is in the form of a coaxial cable with a Be core, a MgO dielectric, and a stainless steel outer conductor. He-6 is produced by the Be-9(n, alpha) reaction; the beta decay of He-6 provides a flow of charge which can then be monitored by electronic instrumentation outside the reactor. A rod 1/8 in. in diameter has a sensitivity of about 10 to the minus 22nd power amp/nv; hence, for a flux level of 10 to the 16th power nv, the sensor produces 1 micron A of dc current. The Be-9 burn up rate predicts a burn up of only 5.41 × 10 to the minus 25th power %/nvt; this means a 10% drop in signal power after 60 years for the stated flux level. NSA

N71-25712# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
EVALUATION OF PuO2 HOMOGENEITY IN PuO2-UO2 FAST REACTOR FUEL BY SCANNING ELECTRON MICROPROBE
D. A. Stranik, H. G. Powers, and G. A. Last 1970 13 p refs
Presented at the 1970 Winter Meeting of the Am. Nucl. Soc., Washington, D.C., 15–19 Nov. 1970 Prepared in cooperation with WADCO Corp.
(Contracts AT(45-1)-1830; AT(45-1)-2170)
(WHAN-SA-7; CONF-701102-17) Avail: NTIS

The theory and the experimental data for measuring homogeneity of fuel pellets based on the functional performance requirements of the fuel in the reactor are presented. The functional performance is the thermal response of the mixed oxide fuel under transient conditions. Two tests were designed in order to derive the homogeneity model. The first test was designed to determine quantitatively by use of the scanning electron microprobe PuO2 concentrations, sizes of PuO2 enriched or depleted zones and the frequency of occurrence. The pellets were irradiation test pellets taken from 23 sintering batches. From the data, a theoretical homogeneity model was established based on heat generation rates and energy disposition within the UO2-PuO2 pellets. A second test was designed to verify the model and to determine the homogeneity of several pellets with a wide range of homogeneities based on alpha-autoradiographs. Author (NSA)

N71-25713# Battelle Memorial Inst., Columbus, Ohio.
DEVELOPMENT AND OPERATION OF AN APPARATUS FOR IN-PILE CREEP STUDIES OF LMFBR FUELS
Richard A. Robinson, Samuel J. Basham, and James S. Perrin Jan. 1971 26 p refs
(Contract W-7405-eng-92)
(BMI-1894) Avail: NTIS

An apparatus for obtaining data on the compressive creep of ceramic fuel materials during irradiation was designed and operated. The specimen was fabricated in the shape of a hollow cylinder to reduce temperature gradients caused by fission heating and to allow placement of creep probes near the ends of the specimen. A compressive load was applied to the specimen through a bellows-sealed, gas-actuated piston. Specimen temperatures were maintained by a resistance-wire heater. Axial creep of the fuel was measured by transmission of the motion through bellows-sealed probes linked to a pneumatic displacement transducer with a variable-area orifice. The apparatus was designed to operate with fuel temperatures in the range from 900 to 1300 C, stress levels of 1,000 to 12,000 psi, and fission rates ranging up to 2 × 10 to the 13th power fissions/cc-sec. Author (NSA)

N71-25731# Argonne National Lab., Ill.
SAFETY PROBLEMS OF LIQUID METAL COOLED FAST BREEDER REACTORS
C. N. Kelber, A. M. Judd, G. Cinelli, Jr., C. E. Dickerman, H. K. Fauske et al Feb. 1970 216 p refs
(Contract W-31-109-eng-38)
(ANL-7657) Avail: NTIS

The safety problems related to the design of cores for liquid-metal-cooled fast breeder reactors are reviewed. A phenomenological representation is related to potential accidents, and this representation is used to describe the program of work needed to develop adequate design principles. Some of the program requires massive in-pile installations for execution, and some is typical of work carried out in many university and industrial laboratories. Author (NSA)

N71-25785# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
AEC REACTOR DEVELOPMENT AND TECHNOLOGY PROGRAMS Technical Activities Quarterly Report, Jul.–Sep. 1970
Oct. 1970 130 p refs
(Contract AT(45-1)-1830)
(BNWL-1522-1) Avail: NTIS

Brief technical discussions are presented on developments in reactor technology. Plutonium dioxide and uranium dioxide fuels, transient and defect testing, plutonium and fission product migration in mixed oxide fuels, nuclear graphite, corrosion product transport, and computer programs are summarized for plutonium recycle test, Saxon, and high temperature lattice reactors. J.M.

N71-25776# Teledyne Isotopes, Timonium, Md. Nuclear Systems Div.
SNAP 19 TAGS 85/2N, RTG POWER SYSTEMS Semiannual Progress Report, 1 Jul.–31 Dec. 1970
Jan. 1971 144 p refs
(Contract AT(29-2)-2873)
(INSD-2873-44; SAPR-3) Avail: NTIS

Work on redesign of the heat source capsule support to minimize impact loading on the generator heat shield and converter components during severe dynamic environments of the Pioneer launch is described. A firm, lasting constraint of the fuel capsule was conceived, implemented, and tested successfully. This enabled fabrication and fueling of the first RTG, S/N 37, with confidence in its ability to withstand qualification level testing. Other generator design and analysis work is reported on design of integrally machined handling lugs to facilitate fabrication, modification of intermodule electrical connection to provide strain relief, replacement of safety wiring with bolt retainers to expedite fueling operations, RTG design for Viking mission, mass properties prediction updated to include measured component weight and dimensions, component structural analyses performed to validate adequacy of the heat source support, updated reliability and performance evaluation for the Pioneer mission, and prediction of RTG design performance for the Viking application. Author (NSA)

N71-25777# Argonne National Lab., Ill.
OUT-OF-PILE STUDY OF THE EFFECTS OF THERMAL GRADIENTS ON THE DISTRIBUTION OF PLUTONIUM IN FAST REACTOR FUEL MATERIALS
M. G. Chasanov and D. F. Fischer Jul. 1970 30 p refs
(Contract W-31-109-eng-38)
(ANL-7703) Avail: NTIS

Annealing of ceria-urania and plutonia-urania pellets in thermal gradients resulted in apparent increases in cerium and plutonium concentrations at the hotter end of the samples. These results are discussed in terms of various possible mechanisms. Similar experiments on mixed carbide samples indicated that vaporization losses of plutonium from the hotter end, although extensive under some conditions, can be minimized by the use of cladding. Author (NSA)

N71-25780*# Hittman Associates, Inc., Columbia, Md.
CWO NO. 6, RTG USER ACTIVITIES IN AEROSPACE

NUCLEAR SAFETY AND OPERATIONS: AN INTERIM RESOURCE ESTIMATE
7 May 1971 58 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952812)
(NASA-CR-118633; HA-3908-6-2) Avail: NTIS CSCL 18M

The efforts which the Jet Propulsion Laboratory as the radioisotope thermoelectric generator (RTG) user will have to perform as part of an outer planets spacecraft program are described. Six major areas of work are identified including safety documentation support requirements, launch approval request, design support activities, on-lab and launch site operations, emergency procedures manual, and the user's safety analysis report. In each work area a general description of user requirements is presented. The descriptions are one step removed from the point where manpower allocations can be assigned. Each of the six areas of work is broken down to identify those aspects of the task which relate to nuclear safety and those which reflect the category of operations. In addition, the role of various JPL groups is described. Author

N71-28783*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NUCLEAR POWERED AIR CUSHION VEHICLES FOR TRANSOCEANIC COMMERCE
Frank E. Rom and Charles C. Masser Washington May 1971 52 p refs
(NASA-TM-X-2293; E-6152) Avail: NTIS CSCL 21F

Large air-cushion vehicles (ACV's) greater than 3620 metric tons (4000 tons) gross weight, have the potential for hauling transoceanic cargo at rates in the range of $0.006 to $0.012 per metric ton-kilometer ($0.010 to $0.020/ton-n mi) at speeds of 185 kilometers per hour (100 knots). It theoretically would take a fleet of over 1000 10,000-metric-ton-gross-weight ACV's to handle 10 percent of the world transoceanic trade projected for 1985. ACV's using compact lightweight nuclear reactors show clearly superior performance for ranges of 3710 kilometers (2000 n mi) or greater. For a range of 7420 kilometers (4000 n mi) the total operating cost for chemical ACV's is three times that for nuclear ACV's. The nuclear ACV performance is less sensitive than the chemical ACV to the operating and cost assumptions used. Relatively large variations in any of the important assumptions had a relatively small effect on nuclear ACV performance. Author

N71-28788# WADCO Corp., Richland, Wash.
[REACTOR FUELS, MATERIALS, DESIGN, AND TECHNOLOGY] Quarterly Technical Report, Jul. - Sep. 1970
Jan. 1971 552 p refs
(Contract AT(45-1)-2170)
(WHAN-FR-50) Avail: NTIS

Progress is described for work on the following programs: FFTF plant design and construction, components design and development, instrumentation and control, sodium technology, and core design, physics, and safety. Also reviewed are accomplishments in fuels and materials evaluation, processing, and fabrication. E.C.

N71-28282# Army Engineer Reactors Group, Fort Belvoir, Va. Engineering Div.
MH-1A HIGH TEMPERATURE PROTECTION SYSTEM
David E. Locke and Patrick Jacobs 1 Mar. 1971 39 p refs
(AD-720593; ED-7104) Avail: NTIS CSCL 18/9

The problems in the present MH-1A Temperature Protection System are discussed and three possible solutions are presented. Author (GRA)

N71-28402# Kernforschungszentrum, Karlsruhe (West Germany).
OPTIMIZATION OF REACTOR THERMAL DESIGN BY STATISTICAL HOT SPOT ANALYSIS
A. Amendola Nov. 1970 22 p refs
(EURFNR-863; KFK-1284; EUR-3882) Avail: NTIS

The influence of temperature and power flattening on the hot channel factor is examined for uniform slab and cylindrical cores. It is shown that, at constant hot channel probability, the maximum available power and maximum average coolant temperature do not coincide with the condition of complete flattening; this is due to the consequent increase in the overall hot channel factor. However the difference between optimum condition and complete flattening is small. This result is applied to the optimization of the distribution of the coolant flow rate among the several subassemblies of a sodium-cooled fast reactor. By a comparison between different design criteria, it is shown that, for given power distribution and inlet temperature, distributing the coolant in such a way, that the probability of hot spots is constant in each subassembly, results in a higher average coolant temperature at core outlet, that is in a better reactor efficiency. Author (NSA)

N71-28471# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
NEUTRON STUDIES ON PLUTONIUM IN THERMAL REACTORS Final Report [ETUDE NEUTRONIQUE DU PLUTONIUM DANS LES REACTEURS A NEUTRONS THERMIQUES]
R. Bir, R. Vidal, M. Livolant, M. Chabrillac, F. Penet et al Nov. 1970 233 p refs Sponsored by Eurstom
(EUR-4477-f) Avail: AEC Depository Libraries

The survey of the work made since 1958 by the C.E.A. on plutonium-bearing fuels and fuel irradiated in nuclear power plants is reviewed. Methods used for fuel analyses are described: isotopic dilution method and its recent improvements, physical methods based on the counting of neutrons from the spontaneous fission of Pu-240, or of alphas emitted by plutonium. An accuracy of about 0.4% has been achieved. Codes for cell computations have been developed. They use simultaneously a special space treatment (zones source method) and the secondary thermalization model (Cadillac model). These time-saving codes are used for routine computations. For more refined calculations, an improved THERMOS code is used. Experimental studies on U-Pu alloys and on irradiated samples were made by replacement and oscillation techniques. Their interpretation has led to recommended values for constants of Pu-bearing fuels. Author (NSA)

N71-28519# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorwerkstoffe.
COATING OF FUEL ELEMENT PARTICLES BY PROPENE PYROLYSIS IN 1 INCH AND 2 INCH FLUIDIZED BED [BESCHICHTUNG VON KERNBRENNSTOFFTEILCHEN DURCH PROPENPYROLYSE IM 1 ZOLL UND 2 ZOLL FLIESSBETT]
E. Gyarmati and H. Nickel Aug. 1970 35 p refs In GERMAN
(JUL-686-RW) Avail: AEC Depository Libraries

Results of studies on pyrolytic carbon deposition from propene (C3H6) and methane (CH4) are presented. It was found that pyrolytic carbon with different structure such as columnar, granular, dense-isotropic, sooty-isotropic, and porous can be deposited on fuel particles in 1- and 3-inch fluidized beds dependent on the propene concentration and the deposition temperature. Methene decomposition leads to laminar, granular, isotropic, and columnar pyrolytic carbons with the structure depending on the CH4 concentration and temperature. Fuel particles with isotropic high-density pyrocarbon show the best irradiation behavior. Pyrolysis of propene within a temperature range between 1250 and 1350 C results in a high density isotropic layer which is comparable to layers produced with methane above 1800 C. The density of the PyC deposited by pyrolysis of C3H6 reaches a minimum at a deposition temperature of 1500 C and increases with further increase in temperature. Author (NSA)

N71-26520# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.

OPTIMIZING SODIUM-COOLED FAST BREEDER REACTORS BY THE METHODS OF NONLINEAR PROGRAMING [OPTIMIERUNG NATRIUMGEKUEHLTER SCHNELLER BRUTREAKTOREN MIT METHODEN DER NICHTLINEAREN PROGRAMMIERUNG]

G. Heusener Jul. 1970 109 p refs In GERMAN; ENGLISH Summary

(KFK-1238) Avail: AEC Depository Libraries

Methods of nonlinear programming are used to optimize fast breeder reactors. Two different procedures, a systematic one (method of steepest descent) and a statistical one (evolution strategy), are described. Their advantages and disadvantages are discussed. As example for the application of these methods, a core optimization for sodium cooled 1000 MW(e) breeder reactors with oxide and carbide fuel is considered. In order to reduce the needed computer time, approximations in nuclear computations are necessary. A procedure is described which allows a fast and sufficiently accurate estimation of the nuclear results. The optimization is performed with regard to two different criteria. The resulting design characteristics are discussed. Using importance quantities, which are obtained as part of the solution, the influence of the design limits upon the optimization criterion is predicted quantitatively. Author (NSA)

N71-26521# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

EL-600 SPACE-DEPENDENT KINETIC PROBLEMS [EL 600 PROBLEMES DE CINETIQUE DEPENDANT DE L'ESPACE]

S. Goldstein 1970 22 p refs Presented at the CREST Meeting on Reactivity Effects in Large Power Reactors, Ispra, Italy, 28 – 30 Oct. 1970

(CEA-CONF-1726; CONF-701019-4) Avail: AEC Depository Libraries

Two problems in spatial kinetics encountered and solved in the EL-600 project are presented. The first problem concerns the safety aspects associated with the rapidly occurring phenomena resulting from a break in the large primary piping: boiling in the channel (the increase in reactivity throughout the reactor core being essentially constant and the void coefficient of the coolant being positive); the dropping of the control rods after a given dead time. The second problem concerns slow xenon poisoning phenomena. NSA

N71-26618# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

THE NATURAL CONVECTION IRRADIATION DEVICE ESTHER [DISPOSITIF D'IRRADIATION A THERMOSIPHON ESTHER]

Jacques Leclere, Andre Lhermenier, Denis Fages, and Jean-Claude Lauthier Oct. 1970 47 p In FRENCH

(CEA-N-1348) Avail: AEC Depository Libraries

In order to perform radiation experiments on fast reactor fuels, a device which was to be used in the Siloe and Osiris swimming pool reactors was designed and constructed. The Esther device is characterized by natural convection cooling. The temperature distribution is analogous to that in a reactor channel. The temperature is adjusted by a variable thermal barrier. The flux level is increased by moving towards the core. This device can dissipate between 800 and 900 W/cm. Its main interest lies in the circulation of Na or NaK along the fuel element. Author (NSA)

N71-26636# Central Research Inst. for Physics, Budapest (Hungary).

COBRA: COMPUTER PROGRAM FOR COOLANT BOILING IN ROD ARRAYS

J. Vigassy Jun. 1970 14 p refs

(KFKI-70-20-RPT) Avail: AEC Depository Libraries

Status report is given about the existing versions of the COBRA code for the computer ICL-1905 of the CRIP. A short code description, user's manual as well as some ideas for the code development are shown. Author (NSA)

N71-26653# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.

INVESTIGATION OF WEAR AND FRICTION BETWEEN FUEL ROD BUNDLES AND SPACER GRIDS IN SODIUM [UNTERSUCHUNGEN ZUM VERSCHLEIB UND ZUM REIBVERHALTEN ZWISCHEN BRENNSTABBUENDEL UND ABSTANDSHALTERGITTERN IN NATRIUM]

K. Kleefeldt Oct. 1970 20 p In GERMAN

(KFK-1290) Avail: AEC Depository Libraries

Results of experiments in sodium in which the friction between fuel element bundle and spacer grids were investigated up to temperatures of 680 C are described. The frictional forces produced were 5 to 20 kg per spacer grid in sodium and higher in air and argon. For two different spacer designs a critical frictional force of approximately 55 kg and 60 to 80 kg, respectively, was determined. If the frictional force exceeds this critical value due to a lack of clearance, the bowing of the grid leads to a clamping effect and to plastic deformation. Repetitive movement of the bundle causes the spacer grid to rupture. The increase in clearance by wear is less than 0.02 mm. Diffusion welding of joints in sodium was not detectable after seven days of shutdown period at 600 C. Discussions are included on the advantages and drawbacks of the selected methods of spacer grid fastening. Author (NSA)

N71-26663# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material- und Festkoerperforschung.

STOICHIOMETRIC SHIFT IN AN OXIDE FUEL ELEMENT AT HIGH BURNUP

H. Holleck and H. Kleykamp Aug. 1970 74 p refs In GERMAN

(KFK-1181) Avail: AEC Depository Libraries

The contributing factors leading to a change in stoichiometry of an oxide-fuel during burnup are discussed. The arising fission products altered the average final stoichiometry, while gas equilibria above the oxide determines the stoichiometry at a particular point. Experimental results concerning irradiated samples are discussed and related to equilibrium states in fuels with high burnup. Author (NSA)

N71-26664# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.

SOME CONSIDERATIONS ON COATED PARTICLES, WITH OXIDE FUEL, AND GRAPHITE AND SILICON CARBIDE COATING, FOR GAS COOLED FAST REACTOR APPLICATION

M. Dalle Donne and G. Schumacher Jul. 1970 35 p refs

(EURFNR-834; EUR-4318; KFK-1254) Avail: AEC Depository Libraries

Coated particles with a SiC outer coating layer were proposed for gas cooled fast reactor applications. SiC is a very fragile material. Although under fast irradiation, it can creep at relatively low temperatures, a very low strain (>0.3%) can produce hairline cracks. A SiC coating layer can therefore withstand only moderate overpressures when subjected to large fast neutron exposures. The pressure inside the particle due to gas fission products and Co-CO2 is calculated. The operation temperature of the particle due to the condition strain less than or equal to 0.3% is given as a function of SiO layer thickness. Author (NSA)

N71-26665# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.

SEGREGATION OF URANIUM AND PLUTONIUM IN OXIDE FUEL UNDER THE INFLUENCE OF A TEMPERATURE GRADIENT

Gustav Schumacher Jul. 1970 102 p refs In GERMAN
(NP-18556; INR-4/70-27) Avail: AEC Depository Libraries

An apparatus was constructed for investigations of separation processes in mixed (U,Pu) oxide fuel materials subjected to a temperature gradient. The cylindrical specimens in sealed tungsten containers were exposed to temperatures up to 2800 K and longitudinal gradients up to 2000 K/cm. The measurement of the concentration by alpha-counting showed a decrease of plutonium in the columnar grain region and an accumulation at the hot end of the specimens. This separation is due to three processes, each of which causes a characteristic distribution of the plutonium concentration. The processes are: (1) preferential evaporation at the surface of the specimens, (2) preferential evaporation and condensation in migrating voids and (3) thermal diffusion. For the thermal diffusion a heat of transfer of 35 kcal/mol is estimated and longtime effects are calculated. The results of this study allow a discussion of the separation effects in reactor fuel elements.
Author (NSA)

N71-26883 Florida Univ., Gainesville.
SPACE-TIME REACTOR KINETICS STUDIES WITH THE UNIVERSITY OF FLORIDA SPERT ASSEMBLY
Nils J. Diaz (Ph.D. Thesis) 1969 284 p
Avail: Univ. Microfilms Order No. 70-11739

A large-in-one-space dimension, side reflected, highly multiplicative subcritical assembly was designed and calibrated. The sole purpose of the facility is the experimental investigation of the dynamic behavior of large reactor cores and to provide a test for space-time kinetics models presently in use. For the kinetics studies, a fast data acquisition system was developed to handle accurately the very high, time-changing count rate encountered in the measurements. The space-time kinetic studies were performed by analyzing the propagation of a fast neutron burst introduced at one end of the assembly, in the absence of inherent feedback effects. The experimental results are compared with the results obtained from the two group, space-time dependent, one-dimensional diffusion theory scheme known as the WIGLE program. The WIGLE calculational scheme accurately predicts the delay times and the attenuation of the pulses when a first flight spatial distribution is assumed for the fast source. Dissert. Abstr.

N71-26884 Rensselaer Polytechnic Inst., Troy, N.Y.
ANALYTIC STUDIES OF FAST REACTOR FLUX AND IMPORTANCE SPECTRA
Floyd Eugene Dunn (Ph.D. Thesis) 1969 286 p
Avail: Univ. Microfilms Order No. 70-11315

A model was developed that leads to analytic expressions for fast reactor fundamental mode flux and importance spectra. In the process of developing the model it was necessary to make improvements in slowing down theory. When these improvements are incorporated into the model, both the gross shape and the detailed fluctuations of the flux spectrum are given accurately. The importance spectrum also gives fairly good agreement with multigroup spectra. For a number of different compositions, comparisons were made between model spectra and multigroup spectra calculated using the same basic cross section data. For all of these cases, the gross shape of the model importance spectrum agrees fairly well with multigroup results. Both broad group (29 group) and detailed (1980 group) comparisons were made with the flux spectrum. The model spectra agree well with multigroup spectra, and integral quantities calculated with the spectra agree very well. The model provides a fairly simple method for calculating spectra by hand. Dissert. Abstr.

N71-26738# European Atomic Energy Community, Karlsruhe (West Germany).
IRRADIATION OF ZIRCALOY CLAD VIBRATED UO2-PuO2 FUEL IN THE BR2 REACTOR
M. Coquerelle and A. Lhost Jun. 1970 42 p refs Sponsored by US-Euratom Prepared in cooperation with Soc. Belge pour l'Industrie Nucl.
(EURAEC-2146; EUR-4035; BN-7006-07) Avail: NTIS

Results of dimensional examination showed that very little swelling occurred in the rods during irradiation. Radiography revealed a central void in the otherwise homogeneous rod. Data on gases collected by puncture methods are included along with data on thermal power involved in the tests and data resulting from radiochemical measurements. NSA

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N71-25610# Brandeis Univ., Waltham, Mass. Dept. of Physics.
LOW TEMPERATURE PROPERTIES OF LIQUID AND SOLID HELIUM Annual Progress Report, 1 Dec. 1969 – 30 Nov. 1970
Daniel H. Cohen 1970 12 p refs
(Contract AT(30-1)-3951)
(NYO-3951-3; APR-3) Avail: NTIS

Exchange energies were determined from magnetic susceptibility measurements of the effect of He-4 impurities in He-3. Measurements were made at low temperatures at a He-4 concentration of 0.0002 and molar volumes of 21, 23, and 24 cc/mole. Developments in techniques to be used in experiments on light scattering in gases at room temperature are described.
N.E.N.

N71-25635# Signals Research and Development Establishment, Christchurch (England).
DETERMINATION OF THE SCATTERING LOSS IN OPTICAL GLASS FIBRES
Margaret A. Orsborne Dec. 1970 28 p refs
(SRDE-70064) Avail: NTIS

The equipment and method used to determine the total loss of power due to all forms of scatter within multimode optical glass fibers are described. Author (ESRO)

N71-25733# Chicago Univ., Ill. Dept. of Astronomy.
INVESTIGATIONS ON ASPECTS IN CLASSICAL PHYSICS Final Report
S. Chandrasekhar 1 Mar. 1971 13 p refs
(Contract Nonr-2121(24))
(AD-719914) Avail: NTIS CSCL 20/10

Investigations under the Contract have mainly been in two categories: the classical theory of the ellipsoidal figures of equilibrium and the development of a post-Newtonian theory of hydrodynamics in the framework of general relativity. A complete list of publications under the contract, is given. GRA

N71-25734# Purdue Univ., Lafayette, Ind. Dept. of Physics.
MAGNETIC MOMENTS OF THE FIRST 2(+) STATES IN Os 192 AND Pt 192
William C. King, Z. W. Grabowski, and R. P. Scarenberg [1970] 10 p refs
(Contract AT(11-1)-1746)
(COO-1746-53) Avail: NTIS

Perturbed angular correlation measurements of the magnetic moments of the first 2(+) states in Os-192 and Pt-192 give 0.797 + or − 0.036 and 0.90 + or − 0.11 micron sub N, respectively. Results agree with the 2(Z/A) values and differ appreciably from the Kumar and Baranger model predictions. Measurements using Fe(Ir) and Ni(Ir) alloys established the unsuitability of Fe(Ir) alloys

for such experiments. The NMR measurements of internal fields for Os-187 in Fe and Ni give H(296 K) = −1093.43 + or − .65 koe and H(295 K) = 282.3 + or − 1.0 koe, respectively. Author (NSA)

N71-25784*# Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.

RESULTS OF INITIAL PROP-FAN MODEL ACOUSTIC TESTING. VOLUME 2: APPENDICES B THRU F

F. B. Metzger and T. G. Ganger 4 Dec. 1970 305 p

(NASA Order L-60739)

(NASA-CR-111842-2; HSER-5787-Vol-2) Avail: NTIS HC $6.00/MF $0.95 CSCL 20A

Stationary microphone test data from the prop-fan model test are presented along with an evaluation of the accuracy of the data. Appendices contain: the one-third octave band data for the far-field tests conducted with the static shroud installed; the narrow band data for the far-field tests conducted with the static shroud installed; the one third octave band data for the near-field tests conducted with the static shroud installed; and the one third octave band data for the far-field tests conducted with the compromise shroud installed. Author

N71-25785*# Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.

RESULTS OF INITIAL PROP-FAN MODEL ACOUSTIC TESTING. VOLUME 1: DISCUSSION

F. B. Metzger and T. G. Ganger 4 Dec. 1970 58 p refs

(NASA Order L-60739)

(NASA-CR-111842-1; HSER-5787-Vol-1) Avail: NTIS CSCL 20A

Results are summarized of a test program conducted to explore the low noise potential of the prop-fan, a high bypass ratio, low pressure ratio, variable pitch propulsor. Far field noise data and directional character of a 21-inch diameter prop-fan model were determined for two shroud configurations, a bellmouth test shroud and a takeoff/cruise shroud. In addition, near field data were obtained for the bellmouth test shroud. Review of the data reinforce earlier conclusions that a large STOL aircraft powered by prop-fans has the potential to meet the objective of 95 PNdB at 500 feet with modest acoustic treatment. Author

N71-25826# Westinghouse Research Labs., Pittsburgh, Pa.

ACOUSTIC OUTPUT OF A LONG SPARK

G. A. Dawson, C. N. Richards, E. P. Krider, and M. A. Uman *In its* A Comparison of Nat. Lightning and the Long Lab. Spark with Appl. to Lightning Testing Aug. 1970 3 p refs Repr. from J. Geophys. Res., v. 73, no. 2, 15 Jan. 1968 p 815–816 Prepared in cooperation with Arizona Univ., Tucson (See N71-26823 14-20)

Avail: NTIS

Measurements have been made on the acoustic output of the spark from a 6.4 megavolt impulse generator. For these experiments, the applied generator potential was 4.8 megavolt, with a 1.5 microsecond rise time, and the rod-plane gap length was set at 4 meters. The acoustic detector was a miniature piezo-electric pressure transducer fitted into a small megaphone to improve coupling. At a distance of 17 meters from the spark, the dominant frequency (as determined by the separation between pressure extrema) lay in the range 1350 to 1650 Hz, with a most frequent occurrence of approximately 1550 Hz. The signals were characterized by an initial large amplitude wave, the first excursion of which corresponded to a compression, followed by a long-duration, small amplitude component of similar frequency. Author

N71-25878# School of Aerospace Medicine, Brooks AFB, Tex.

INDUSTRIAL NOISE AND COUNTERMEASURES. CHAPTER 5: NOISE RESEARCH METHODS MEASURING DEVICES

Il'ya Il'ich Slavin 1971 44 p Transl. into ENGLISH of the RUSSIAN book

(AD-720414; SAM-TT-R-1002-0371) Avail: NTIS CSCL 20/1

Contents: Subjective methods and devices; Objective sound level meter; Frequency analyzer; Band analysis of noise; Graphic representation of noise spectrums; Noise registration. GRA

N71-25898# ARO, Inc., Arnold Air Force Station, Tenn.

SUPER- AND SUB-SPECULAR MAXIMA IN THE ANGULAR DISTRIBUTION OF POLARIZED RADIATION REFLECTED FROM ROUGHENED DIELECTRIC SURFACES Final Report, May 1969 – Apr. 1970

A. M. Smith and P. R. Muller AEDC Mar. 1971 34 p refs

(Contract F40600-71-C-0002)

(AD-720802; AEDC-TR-70-286) Avail: NTIS CSCL 20/6

To study the effects of surface roughness on the reflection of radiation from the vacuum-deposit interface of CO2 cryodeposits, detailed angular distribution measurements were made of the polarized radiant flux reflected from roughened glass samples which had similar optical properties to CO2 cryodeposits. As a result of these measurements, a new type of off-specular peak was discovered. A formula is derived for the radiation reflected in the plane of incidence and is used to quantitatively confirm the existence of the super- and sub-specular maxima for moderate incidence angles. The super- and sub-specular maxima phenomena have potential application to making in situ measurements of surface roughness characteristics. Author (GRA)

N71-26187# Texas Univ., Austin. Electronics Research Center.

ACOUSTIC ENERGY TRANSMISSION FROM A ROD INTO A SEMI-INFINITE MEDIUM

Gerald G. Maxwell and E. L. Hixson 2 Sep. 1970 96 p refs

(Grant AF-AFOSR-1792-69)

(AD-720270; TR-98; AFOSR-70-2627TR) Avail: NTIS CSCL 20/1

The solution of the problem of the semi-infinite, cylindrical, elastic, homogeneous rod set in an infinite baffle and radiating into a semi-infinite liquid, non-viscous medium is the subject of this report. An approximation method is utilized. The axisymmetric stress fields in the rod are expressed as infinite sums over eigenvalues which are solutions of the dispersion boundary conditions for the rod. The pressure in the liquid is derived using the Greens functions technique. An infinite series of integrals is the result as the velocity of the rod (which is expressed as an infinite series) must be inserted in the integral expression for pressure. In order to solve the problem numerically these infinite sums are truncated. By matching the boundary conditions across the interface the velocity profile is obtained which can then be used to construct the farfield radiation patterns in the liquid. Power, radiation impedance, beam width, directivity factor and directivity index are calculated from the fields. Author (GRA)

N71-26206* Trident Engineering Associates, Inc., Annapolis, Md.

SPECTROSCOPE EQUIPMENT USING A SLENDER CYLINDRICAL REFLECTOR AS A SUBSTITUTE FOR A SLIT Patent

Ralph A. Goodwin and Edgar D. Hall, inventors (to NASA) Issued 12 Jan. 1971 4 p Filed 27 Dec. 1968 Cl. 356-76; Int. Cl. G01j3/40, 3/42 Sponsored by NASA

(NASA-Case-XGS-08269; US-Patent-3,554,647; US-Patent-Appl-SN-787393) Avail: US Patent Office CSCL 20F

A small-diameter cylindrical reflector for resolving a wide angle light beam from an astronomical telescope into a narrow beam suitable for spectroscopic analysis is described. The needle-like reflector is interposed between the telescope and the image converter, entails less complicated and cumbersome equipment than a slit configuration, and permits simultaneous observation of the telescopic image and a spectral reading. N.E.N.

N71-26221# Naval Undersea Research and Development Center, San Diego, Calif.
UTILITY INFRANSONIC MONITORING SYSTEM, M-7 Research and Development Report, Jan. 1969–Jun. 1970
T. McMillian, D. R. Schmidt, and W. T. Hedrick Jan. 1971 78 p refs
(AD-720689; NUC-TP-219) Avail: NTIS CSCL 20/1

A Utility Infrasonic Monitoring System, M-7, functionally similar to the M-4 system developed by ESSA, was designed and developed. The system is easy to transport and install, operable without commercial power or telephone lines, and workable for extended periods without servicing. The system is provided with noise-reducing arrays, sensors, electronics equipment, a timing system, and both magnetic-tape and ink-on-paper-tape recorders. The system can operate with a single sensor or with as many as six sensors, and it can record all data at a single location or at each sensor. Author (GRA)

N71-26238*# Rensselaer Polytechnic Inst., Troy, N.Y.
STUDY OF RADIATION EFFECTS IN LITHIUM-DOPED Si USING INFRARED SPECTROSCOPY (1 TO 50 MICRONS) AND PHOTOCONDUCTIVITY (1 TO 10 MICRONS)
T. Mortka and J. C. Corelli *In* JPL Proc. of the 3d Ann. Conf. on Effects of Lithium Doping on Silicon Solar Cells 1 Apr. 1971 p 107–112 refs (See N71-26226 14-03)
Avail: NTIS CSCL 20L

Radiation damage in Li-doped silicon due to 1.5, 5, and 45 MeV electrons was studied. Both floating zone and crucible grown silicon were used and were phosphorus-doped to 1 and 10 ohm-cm. Infrared spectroscopic and photoconductivity measurements were made of the long-time stability. No systematic variation of radiation damage with variations of experiment parameters was found. A drastic effect of radiation energy and total fluence upon the annealing behavior of the 9.9 micron band was noted. The strength of the 1.8 micron di-vacancy band varies inversely with the lithium concentration, with 1.4 and 1.7 micron bands replacing the 1.8 micron band. Photoconductivity, IR correlation, and di-vacancy band details are given for two samples. N.E.N.

N71-26265# Forsvarets Forskingsanstalt, Stockholm (Sweden).
MAGNETO OPTIC HYSTEROGRAPH [MAGNETO-OPTISK HYSTEROGRAF]
Ingvar Langlet Sep. 1969 72 p refs In SWEDISH
(FOA-3-C-3607-10) Avail: NTIS

A magneto-optical hysterograph has been developed for investigating hysteresis in thin magnetic films. Described are the working principle and construction of the hysterograph together with its function and use. Author

N71-26275# Pennsylvania State Univ., University Park. Ordnance Research Lab.
ACOUSTIC RADIATION FROM VIBRATING PROLATE SPHEROIDS
Gerald C. Lauchle (M.S. Thesis) 3 Jun. 1970 83 p refs
(Contract N00017-70-C-1407)
(AD-720714; TM-504-03) Avail: NTIS CSCL 20/1

Prolate spheroidal coordinates and associated prolate spheroidal wave functions have been used to determine the acoustic radiation from prolate spheroids whose surfaces vibrate arbitrarily. The theory, originally developed to study the sound propagation from submerged spheroids, is general enough to include a wide range of specific acoustic problems such as radiation from nonspherical sources (cylinders with end caps, discs, etc.) and acoustic scattering. Boundary conditions are adjusted to the general solutions of the wave equation to obtain an expression for the sound pressure from which a local model radiation impedance was defined. The application of the theory is demonstrated through numerical calculations of the far-field acoustic radiation from a particular prolate spheroid for which experimental data was available. Author (GRA)

N71-26327# Joint Publications Research Service, Washington, D.C.
THERAPEUTIC EFFECTS OF CONSTANT AND LOW FREQUENCY ALTERNATING MAGNETIC FIELDS
I. L. Degen 11 May 1971 9 p refs Transl. into ENGLISH from Vrachebnoe Delo (Kiev), no. 3, 1971 p 124–128
(JPRS-53091) Avail: NTIS

The biological and therapeutic effects of magnetic fields on the human organism are discussed. Various studies are presented including the relationship of disturbances in terrestrial magnetism and suicides for Zurich and Copenhagen, and diuretic effect of water processed by a magnetic field. It is concluded that existing data are sufficient to support the recommendation to physicians to consider the biological and medical effects of constant and low-frequency variable magnetic fields to expand the range of illnesses for treatment by magnetic fields. F.O.S.

N71-26481# Pennsylvania State Univ., University Park. Materials Research Lab.
OPTICAL INTERFEROMETRY AT HIGH PRESSURES
K. Vedam *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 39–44 refs (See N71-26476 14-12)
Avail: SOD $4.50

After a brief review of the present status of optical interferometry at high pressures, the experimental technique of measuring the variation of refractive index with pressure to 7 and 14 kbars with one- and two-stage optical pressure vessels respectively, is described along with some typical results obtained. The need for such measurements on liquids and gases which are used as fluid pressure media is emphasized. Author

N71-26482# California Univ., Livermore. Lawrence Radiation Lab.
CALCULATION OF EQUATION OF STATE FROM HIGH PRESSURE SOUND VELOCITY DATA
Albert C. Holt and Richard Grover *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 131–135 refs (See N71-26476 14-12)
Avail: SOD $4.50

Described is a method for calculating the Mie-Gruneisen equation of state parameters for simple metals from shock Hugoniot data and a knowledge of the volume variation of longitudinal sound velocity at high pressure. The theory is applied to the calculation of the equation of state of aluminum. Author

N71-26504# Centre National de la Recherche Scientifique, Bellevue (France). Lab. des Hautes Pressions.
EXPERIMENTAL DETERMINATION OF CURIE POINTS OF FERROMAGNETS UP TO 90 KILOBARS: POSSIBLE USE FOR CALIBRATION OF HIGH PRESSURE
J. M. Leger, C. Susse, and B. Vodar *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 251–258 refs (See N71-26476 14-12)
Avail: SOD $4.50

Second order phase transformations which occur without volume discontinuity and theoretically without any hysteresis are suggested as secondary pressure gauges and for interpolation under high pressure in different temperature ranges. Results are presented concerning the shifts of Curie temperatures of some ferromagnets up to 90 kbar. The pressure effect is generally small but may be accurately determined. Author

N71-26509# General Electric Co., Schenectady, N.Y. Research and Development Center.

THE USE OF IRON AND GOLD FOR CALIBRATION OF HIGHER PRESSURE AND TEMPERATURE POINTS

H. M. Strong and F. P. Bundy *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 283–290 refs (See N71-26476 14-12)

Avail: SOD $4.50

A useful experimental procedure is to use one type of phase change as a reference against which other phase relations may be studied. Iron is particularly useful for this purpose because it exhibits several easily observed pressure sensitive solid-solid type phase transformations. It also displays a large thermoelectric pressure error behavior, which when used with Pt and Pt10Rh thermoelectric materials, provides both pressure and temperature references. A high pressure, high temperature fixed reference point is the intersection of two well established phase boundary lines. The effectiveness of this approach to the problem of high pressure, high temperature measurements is illustrated using the diamond-graphite equilibrium and the gold fusion curve. Author

N71-26589# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.

NONRELATIVISTIC TRANSFORMATIONS APPLIED TO THE DIRAC EQUATION

V. N. Strel'tsov 1970 5 p ref In RUSSIAN

(JINR-P2-5314) Avail: AEC Depository Libraries

Nonrelativistic transformations are applied to the Dirac equation. It is shown, for example, that in this case the wave functions obey the transformation formulae of the type psi' = s psi, where s = (1 + beta squared/8) + i sub (gamma 1 gamma 4)(1 + 3 beta squared/8), and beta = v/c. Author (NSA)

N71-26596# Forsvarets Forskningsanstalt, Stockholm (Sweden). Avdelning 3.

SYMPOSIUM ON OPTO ELECTRONIC SIGNAL HANDLING TECHNIQUE, TOENSBERG, NORWAY, 29 SEPTEMBER–2 OCTOBER 1969 [OPTO-ELEKTRONISK SIGNALBEHANDLINGSTEKNIK. SYMPOSIUM I TOENSBERG, NORGE 29.9–2.10 1969]

Staffan Jonsson, Sten Nyberg, and Bo Akerlind Nov. 1969 17 p refs In SWEDISH

(FOA-3-0-3614-62) Avail: NTIS

Lectures concerning electro-optical signal processing techniques are reviewed. Considered are optical data processing, electro-optics, holography, and pattern recognition problems. G.G.

N71-26628# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

CALCULATION OF LOSSES IN SUPERCONDUCTING COILS SUPPLIED BY PULSED CURRENT [CALCUL DES PERTES DE BOBINES SUPRA CONDUCTRICES ALIMENTEES EN COURANT PULSE]

C. Lefrancois 3 Aug. 1970 43 p refs In FRENCH; ENGLISH summary

(NP-18516; SEDAP/70-75-Sup/16) Avail: AEC Depository Libraries

A method to calculate the loss energy produced in a pulsed superconducting magnet of any shape wound with solid core wires is described. The formulae are based on the BEAN's critical state model, and are derived from the simple case of a plane slab in a uniform external magnetic field, carrying a transport current perpendicular to the direction of this field and proportional to it. The computer program takes account of the magnetic field distribution inside the winding, and the total losses in the magnet are obtained by a numerical integration of the elementary losses in small volumes of superconductor which can be assumed to be in a uniform magnetic field. The results are in good agreement with experimental results obtained in our laboratory. Author (NSA)

N71-26630 Maryland Univ., College Park.

THE BEHAVIOR OF THE CAVITY FORMED BY A PROJECTILE ENTERING THE WATER VERTICALLY

Harvey Ira Abelson (Ph.D. Thesis) 1969 209 p

Avail: Univ. Microfilms Order No. 70-11613

Extensive measurements of cavity pressure prior to deep closure have been made for vertical entries of a 140 deg conical-nosed projectile up to 250 fps and correlated with high-speed motion pictures taken of the entries. Results indicate that the pressure drop during the open cavity phase is an order of magnitude greater than previously assumed. No appreciable axial or transverse pressure gradient was found to exist in the cavity during both the open and closed cavity phases. Behavior over the closed cavity phase can be approximately described by the isentropic pressure-volume relation. Cavity shape prior to pullaway is essentially independent of cavity pressure, being a function of the impulse imparted to the water by the projectile. Cavity pressure affects later cavity shapes because of its relation to surface closure and therefore to pullaway. Cavity shapes and pressures determined using the predictive procedure were in good agreement with experimental data. Dissert. Abstr.

N71-26652 California Univ., Berkeley.

NONLINEAR MAGNETOMECHANICAL INTERACTIONS

Marvyn Gary Faulkner (Ph.D. Thesis) 1969 112 p

Avail: Univ. Microfilms Order No. 70-13047

To facilitate the combination of the ordinary mechanical continuum theory with the effects of magnetization and magnetic fields, the overall system is considered as a number of subsystems. These subsystems include the quasi-static magnetic, the kinetic, the thermal, and the material. Consideration of each subsystem alone results in an open system i.e., energy and momentum are supplied from outside the subsystem. In combined energy and momentum balances the quantities in the three subsystems, magnetic, kinetic, and thermal are taken as known; the material subsystem quantities are then determined. To this end invariance requirements and thermodynamic restrictions are used and result in reduced forms of the constitutive assumptions. Magnetic saturation, incompressibility, and dependence of the free energy on the magnetization gradient are also considered and result in modified constitutive laws. Dissert. Abstr.

N71-26654*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

CRYOGENIC COOLING SYSTEM Patent

Raymond E. Fraze, inventor (to NASA) Issued 23 Feb. 1971 6 p Filed 11 Feb. 1969 Cl. 62-514; Int. Cl. F25b19/00 Sponsored by NASA

(NASA-Case-NPO-10467; US-Patent-3,564,866; US-Patent-Appl-SN-798277) Avail: US Patent Office CSCL 20L

A cryogenic cooling system, of general utility, adapted to achieve a high rate of cooling is described. It includes a closed circuit cooling chamber through which there is established a circulating flow of cryogen, such as vaporized nitrogen; an impeller having an air-driven turbine adapted to impart to the impeller selected rates of rotation for accelerating the flow of cryogen through the chamber; an injector for injecting liquid cryogen into the established flow; and an atomizer for atomizing the injected cryogen, whereby the cryogenic liquid may be atomized and vaporized as it is introduced into the established flow of cryogen through the cooling chamber. Official Gazette of the U.S. Patent Office

N71-26671# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

ANALYSIS OF THE EFFECTS OF DISPLACEMENT AND OF POSITIONING OF THE MEASURING PROBE OF A MAGNETIC FIELD ON THE PROPERTIES OF AN OPTICAL SYSTEM [ANALYSE DES EFFETS DU DEPLACEMENT ET DU POSITIONNEMENT DE LA SONDE DE MESURE DU

CHAMP MAGNETIQUE, SUR LES PROPRIETES D'UN SYSTEME OPTIQUE]
M. Ribes and B. Turck 1970 44 p refs In FRENCH
(NP-18519) Avail: AEC Depository Libraries

Magnetic measurement systems often require accuracies better than the accuracy needed for the experiment. It is shown that this requirement is often not necessary. Using a trajectory program for a beam issued from a point object, the image displacements and aberrations created by positional errors of the measuring probe are analyzed. It is pointed out that the effect of these errors depends on the direction in which the probe is moved. Also, it is shown that if the errors at each point of measurement are not independent, the overall effect may be, in some cases, practically negligible. Author (NSA)

N71-26722* Maryland Univ., College Park.
METHOD AND APPARATUS FOR OPTICAL MODULATING A LIGHT SIGNAL Patent
Carl L. Gruber and William E. Richards, inventors (to NASA) Issued 12 Jan. 1971 5 p Filed 29 Aug. 1968 Cl. 331-94.5; Int. Cl. G02f1/28; Int. Cl. H01s3/00 Sponsored by NASA
(NASA-Case-GSC-10216-1; US-Patent-3,555,455; US-Patent-Appl-SN-756260) Avail: US Patent Office CSCL 20F

A method and apparatus for optically modulating a light or microwave beam is described. The apparatus consists of a signal carrier light beam source, a modulating light beam source, and a semiconductor free carrier source. Light beams from the signal carrier source and from the modulating source are directed onto the semiconductor free carrier source. The light from the modulating source varies the transmission characteristics (transparency) of the semiconductor free carrier source to the light beam from the signal carrier light source, thereby modulating the signal carrier light beam. The transmission characteristics of the semiconductor free carrier source are varied by the creating of free carriers in it. The free carriers are created by the modulating light beam. Official Gazette of the U.S. Patent Office

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N71-25601 Rensselaer Polytechnic Inst., Troy, N.Y.
APPLICATIONS OF t-MATRIX PERTURBATION THEORY
An-hua Lu (Ph.D. Thesis) 1969 120 p
Avail: Univ. Microfilms Order No. 70-11326

Three separable approximations are compared for the off-energy shell t-matrix element t(p,k,s) with those for a local central square well potential for negative energy s. It was found that the unitary pole approximation is in general the best of the three one term separable approximations used. In the calculation of triton binding energy for a central, local Hulthen potential, the rate of convergence of the Weinberg-Rotenberg series expansion is examined. It was found that the single term misses the four term result by 40%, two terms have an error of less than 6%, and three terms are good to within 2% of the value for 4 terms. A numerical procedure to evaluate multidimensional integrals was studied. Fuda's first order t-matrix perturbation theory was applied to calculate the triton binding energy for a variety of two body potentials. The perturbation theory gives an error of 0.13 Mev for Mongan's two term separable potential which uses a tensor interaction. Finally, by using t-matrix perturbation theory, a calculation is made of the energy correction to the trinucleon. Dissert. Abstr.

N71-25608 Syracuse Univ., N.Y.
DOUBLE PARTIAL WAVE EXPANSION OF SCATTERING AMPLITUDES: THE GENERAL MASS CASE FOR SPINLESS PARTICLES WITH APPLICATIONS TO ELASTIC PROCESSES AND A SYSTEMATIC ANALYSIS OF THE SEMILEPTONIC DECAY MODE OF THE KAON
Pierre Michel Ramond (Ph.D. Thesis) 1969 101 p
Avail: Univ. Microfilms Order No. 70-10383

The elastic scattering amplitudes of spinless particles are discussed. Explicit construction of the polynomials revelant to this case are shown. The extension to the inclusion of spin is considered in its most elementary form in pion-nucleon scattering. It is also shown that partial wave crossing relations is the direct consequence of crossing symmetry. Sum rules are derived for pion-N scattering. A simple minded model for the partial wave amplitudes is introduced and is shown to lead to inconsistencies in the sum rules. A specific model of K^* dominance and magnetic type K^*K pion coupling is introduced. It is shown that such a model can reconcile the interpretation of the branching ratio and polarization data. A more phenomenological model is shown to lead to the breaking of the mu-e universality hypothesis. Dissert. Abstr.

N71-25609# California Univ., Livermore. Lawrence Radiation Lab.
RATE EQUATION FOR A THERMAL DECOMPOSITION REACTION OF THE REVERSIBLE A(s) EQUALS B(s) PLUS C(g) TYPE OCCURRING IN THE DIFFUSION-KINETIC REGION [KINETICHESKOE URAVNENIE REAKTSII TERMICHESKOGO RAZLOZHENIYA TIPA A(tv) RAVNYA B(tv) PLYUS C(g), PROTEKAYUSHCHEI V DIFFUZIONNO-KINETICHESKOI OBLASTI]
Ya. Pysiak Dec. 1970 7 p refs Transl. into Dokl. Akad. Nauk Belorussk. SSR, v. 14, no. 2, 1970 p 131-133
(UCRL-Trans-10506) Avail: NTIS

A solution for a general rate equation for the case of thermal decomposition of solids occurring in the diffusion-kinetic region is developed. The resulting calculations are found to be in good agreement with experimental data. N.E.N.

N71-25612# North Carolina Univ., Chapel Hill. Dept. of Chemistry.
ORGANIC THIN FILMS: PHOTOEXCITED PROPERTIES AND ELECTRON ENERGY LOSS Annual Progress Report, 1 Sep. 1969 - 1 Sep. 1970
R. C. Jarnagin 24 Sep. 1970 12 p refs
(Contract AT(40-1)-3894)
(ORO-3894-2; APR-2) Avail: NTIS

Continuing research on organic thin films is reported. Descriptions and results of experiments are presented for three separate studies. These studies include: (1) the spatial distribution of newly thermalized electrons initially hot by 0-1 eV, (2) molecular excited state interaction, and (3) inelastic electron energy loss. D.L.G.

N71-25634# European Space Research and Technology Center, Noordwijk (Netherlands).
THE SATURATION GAIN OF CURVED CHANNEL MULTIPLIERS
R. D. Andresen and D. E. Page 1971 8 p refs Submitted for publication
Avail: NTIS

A model is presented dealing with the saturation gain occurring in curved channel multipliers at high applied voltages. Assuming that space charge is the gain limiting process the number of electrons within this cloud is calculated. There exists good agreement between experimental and theoretical saturation gain in the high voltage range applied to the curved channel multiplier. Author (ESRO)

N71-25702# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
TIME-RESOLVED SPARK-SOURCE MASS SPECTROME-

TRY: THE EFFECT OF SPARK DURATION ON RELATIVE SENSITIVITY FACTORS, ION INTENSITY, AND PRECISION OF ANALYSIS

J. C. Franklin (Ph.D. Thesis – Tennessee Univ.) 29 Jan. 1971 121 p refs
(Contract W-7405-eng-26)
(Y-1757) Avail: NTIS

A radio frequency, high voltage spark ion source in conjunction with a double focusing mass spectrometer was used to measure the relative sensitivity factors for several elements in matrices of tin, iron, beryllium oxide, uranium, and steels. The sensitivity factors were examined for concentration and matrix effects. No significant variations were found for the concentration ranges studied, but there were very large sensitivity variations with changes in the matrix type. The precision in determining concentrations and relative sensitivity factors was compared for two methods of data interpretation and, in one case, a decrease in precision was shown to be due to sample nonhomogeneity. A study was made of ion intensity variations with elapsed time in a radio frequency spark pulse. Circuits were designed and installed to synchronize the ion beam chopping circuits with the radio frequency spark pulses so that time resolved spectra were obtained at different periods in the spark pulse. Large variations in the intensity of individual ion intensities were observed. NSA

N71-25703# Addis Translations International, Woodside, Calif.
PROBLEMS OF BEAM OPTICS IN A MULTISECTION 2 GeV ELECTRON LINAC

I. A. Grishaev et al [1970] 29 p refs Transl. into ENGLISH from the Russian report Prepared for Stanford Linear Accelerator Center
(SLAC-TRANS-128; KHFTI-70-18) Avail: NTIS

It is shown that a linear accelerator is capable of particle phase separations, as a result of which the trajectories of particles with different phases are separated in space and the effective output emittance is much greater than the ideal value. Possible methods of using this property to shorten the phase length of a bunch are discussed. The effect of phase fluctuations on the extracted beam parameters is examined, including the emittance in different planes, the energy spectra, and the angular and radial distributions. A method of producing short relativistic electron bunches is described. In this method high frequency transverse fields produce a coupling between the particle phase and its radial-angular characteristics, and this is then used to produce nonisochronous motion of the particles in a longitudinal magnetic field (solenoid) or a quadrupole channel (strongly focusing system of the FD type). The discussed problems were investigated numerically using a model and the M-220A digital computer and the MN-7M analog computer. The emmittance program is described. Author (NSA)

N71-25720# Rochester Univ., N.Y. Dept. of Physics and Astronomy.
THEORY OF SECOND CLASS CURRENTS IN WEAK INTERACTIONS

Susumu Okubo 1970 23 p refs Presented at Coral Gables Conf., Coral Gables, Fla., 20–22 Jan. 1971
(Contract AT(30-1)-875)
(UR-875-331; CONF-710106-1) Avail: NTIS

A simple way of introducing the second class currents has been suggested by naturally incorporating tensor density in the theory. A possible explanation for large Xi and Lambda(+) parameters in K sub 13 decays is also proposed. Author (NSA)

N71-25721# Los Alamos Scientific Lab., N.Mex.
STOPPED MUON CHANNEL FOR LAMPF

V. W. Hughes, S. Ohnuma, K. Tanabe, P. Thompson, and H. F. Vogel May 1970 38 p refs
(Contract W-7405-eng-36)
(LA-4474) Avail: NTIS

The design of the stopped muon channel for LAMPF is discussed in detail, including the characteristics of the output beams with regard to intensity, emittance, polarization, and beam purity. The channel consists of a pion collection and bending portion, an alternating gradient quadrupole portion to capture decay muons, and a final magnetic analyzer portion to provide a pure muon beam. Alternative designs are considered, but none was found to be preferable to the proposed design. Author (NSA)

N71-25722# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Physics.
TWO VARIABLE EXPANSIONS BASED ON THE LORENTZ AND CONFORMAL GROUPS

P. Winternitz 1970 33 p refs Presented at Symp. on the de Sitter and Conformal Groups, Boulder, Colo., 1970 Sponsored by AEC
(TID-25654) Avail: NTIS

A review is given of a scattering theory based on two variable expansions furnished by the Lorentz group. Arguments are given for using the conformal group in such a program, in order to make as much use as possible of relativistic invariance and crossing symmetry simultaneously. Author (NSA)

N71-25723# Chicago Univ., Ill.
THREE COMPONENTS OF D-SPIN

Peter G. O. Freund Jan. 1971 29 p refs
(Contract AT(11-1)-264)
(COO-264-570; EFI-71-1) Avail: NTIS

The concept of D-spin, previously introduced to account for the selection rules for exotic hadron couplings, is further investigated. The three components of D-spin are identified. D sub 3 turns out to be a simple topological characteristic of the way a hadron couples at a vertex. D sub 3 is conserved at hadronic vertices. In hadronic N-point functions an effective D sub 3 is conserved. It is shown that in the presence of three species of quarks (beta, N, lambda) there are three D-spins. An application of the D-spin formalism to diffractive exotic hadron production is presented. Author (NSA)

N71-25724# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.
THEORETICAL RESEARCH IN ELEMENTARY PARTICLE PHYSICS

30 Dec. 1970 19 p refs
(Contract AT(11-1)-264)
(COO-264-568) Avail: NTIS

The theoretical research carried out in high energy physics covers the Veneziano model, dispersion theory, current algebra, duality, scale invariance, Regge pole theory, diffraction scattering, and weak and electromagnetic processes. A list of publications is included. NSA

N71-25725# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
ABSOLUTE EXPERIMENTAL CROSS SECTIONS FOR THE IONIZATION OF SINGLY CHARGED BARIUM IONS BY ELECTRON IMPACT

R. K. Feeney and J. W. Hooper 1 Jan. 1971 144 p refs
(Contract AT(40-1)-3027)
(ORO-3027-18) Avail: NTIS

Absolute cross sections for the single ionization of Ba(+) ions by electron impact were measured as a function of incident electron energy over the electron energy range from below threshold (10.001 eV) to approximately 1000 eV. The measurements were made in an all metal ultrahigh vacuum crossed-beam facility in which approximately monoenergetic beams of Ba(+) ions and electrons were caused to intersect at right angles in a well defined

collision volume. Continuous beam techniques were used for the majority of the measurements, but modulated-beam measurements were used as a check. It was found that the cross section increases from 1.94 × 10 to the minus 16th power to 3.76 × 10 to the minus 16th power sq cm between 15.5 and 18 eV actual incident electron energy. This rapid rise is interpreted as the onset of autoionization. Some evidence of structure occurring near the peak of the cross-section curve (below 100 eV) was observed, but this was not conclusive. The data are compared with existing experimental and theoretical results. NSA

N71-25729# Idaho Nuclear Corp., Idaho Falls.
GAMMA RAYS EMITTED BY THE FISSIONABLE NUCLIDES AND ASSOCIATED ISOTOPES
J. E. Cline Dec. 1970 46 p refs Revised
(Contract AT(10-1)-1230)
(IN-1448-Rev) Avail: NTIS

Data on gamma-ray energies and intensities emitted by the nuclides present in nuclear fuel material are presented. These energies and intensities were measured using a high resolution Ge(Li) spectrometer. Gamma-ray pulse-height spectra are given for reference use. Author (NSA)

N71-25730# Oak Ridge National Lab., Tenn.
A REVIEW OF THE MONTE CARLO METHOD FOR RADIATION TRANSPORT CALCULATIONS
Betty F. Maskewitz and Vivian Z. Jacobs, comps. Feb. 1971 153 p refs Presented at the Monte Carlo Seminar-Workshop, Oak Ridge, Tenn., 5 - 7 Oct. 1970 Sponsored in part by DASA
(Contract W-7405-eng-26)
(DRNL-RSIC-29; CONF-701020) Avail: NTIS

This review consists of 18 papers presented at the Monte Carlo Seminar - Workshop held at Oak Ridge, Tennessee, October 5 - 7, 1970. They constitute a current statement of the state-of-the-art of the Monte Carlo method as used to calculate radiation transport and establish the fact that only this method of solving the Boltzmann transport equation is routinely applied to three-dimensional problems. Several computer codes utilizing the Monte Carlo method were reported. These include: POKER(CEA), ANDY, MCNA and MCP (LASL), FASTER (ART), ANTE (MAGI), ESP and MORSE (ORNL). Author (NSA)

N71-25732# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
THERMODYNAMIC STUDIES ON HEAVY ELEMENTS AND STUDIES IN NUCLEAR CHEMISTRY Annual Report, Feb. 1970 - Jan. 1971
J. W. Cobble, ed. 1 Jan. 1971 24 p refs
(Contract AT(11-1)-1716)
(COO-1716-11) Avail: NTIS

Developments are given for studies on chemically bound neutrons and ternary fission of Th-232 and Au-197 with He-4 ions. In the case of Au-197, success in measuring the formation cross section of a typical ternary product, Mg-28, as low as 0.01 nanobarns. The thermodynamic behavior of a typical actinide ion, UO2(2+), was determined over an extended range of temperature, 0 to 100 C from C(-0) sub p2 measurements. NSA

N71-25737# Oak Ridge National Lab., Tenn.
Al(n,x, GAMMA) REACTIONS FOR 5.3 < or = TO E SUB n < or = 9.0 MeV
J. K. Dickens 18 Jan. 1971 38 p refs Sponsored in part by DASA
(Contract W-7405-eng-26)
(ORNL-TM-3284) Avail: NTIS

Interactions of neutrons with aluminum were studied by measuring gamma-ray-production cross sections. Spectra were obtained for incident mean neutron energies of 5.35, 5.85, 6.4, 6.9, 7.45, 7.95, 8.5 and 9.0 MeV. The gamma rays were detected using a coaxial Ge(Li) detector of 30 cu cm active volume. Data were obtained for gamma-ray scattering angles of 55 deg for all neutron energies for 90 deg for all neutron energies except 5.35 MeV, and 75 deg for neutron energies = 6.4 and 7.45 MeV. The gamma-ray spectra were reduced using a computer system based upon visual display of the data and estimation of the peak area and a simple algorithm was used to estimate the underlying Compton distribution. Absolute cross sections for production of gamma rays were obtained for the incident neutron energies. Gamma rays were found having energies appropriate for ground-state decay of levels at excitation energies of 5.155, 5.414, 5.434, 6.514, 6.821, 6.956, 7.920, 7.411, 7.471, 7.56 (doublet), 7.655, 8.148, and 8.184 MeV. Author (NSA)

N71-25738# Rice Univ., Houston, Tex. Dept. of Chemistry.
RECOMBINATION OF POSITIVE IONS WITH ELECTRONS IN GASES Progress Report, 19 Dec. 1969 - 21 Dec. 1970
J. L. Franklin and P. R. Brooks 22 Dec. 1970 9 p ref
(Contract AT(40-1)-3771)
(ORO-3771-3) Avail: NTIS

Preliminary data obtained during the period on dissociative recombination of N2(+) ions with electrons are reported. The total recombination cross section is estimated to be approximately 10 A(2) at an interaction energy of 3 eV, but it falls off dramatically at energies higher than a few eV. A plot of the angular distribution of the N atoms formed shows a symmetric distribution with a minimum in the center. This shape is related to the conservation of angular momentum. Apparatus improvements made during the year are described briefly. NSA

N71-25740# Los Alamos Scientific Lab., N.Mex.
POLARIZATION OF ELASTICALLY SCATTERED TRITONS AND He 3
D. D. Armstrong and P. W. Keaton, Jr. Oct. 1970 9 p refs
(Contract W-7405-eng-36)
(LA-4538) Avail: NTIS

The measurements of the polarization of tritons elastically scattered from He-4 has established this reaction as a good polarizer (or analyzer) for tritons. The polarization measurements were recently extended over a sufficient angular and energy range to allow a phase-shift analysis that more accurately describes both the cross-section and polarization data. Based on the assumption that the optical model potential for a triton is just the sum of the optical model potentials of its constituent nucleons suitably averaged over their internal motion in the triton, the polarization of tritons elastically scattered from nuclei is expected to be small. Measurements at angles approximately 60 deg) give small polarizations for tritons elastically scattered from nickel and Fe-54. Author (NSA)

N71-25741# California Univ., Berkeley. Lawrence Radiation Lab.
PHYSICS REPORT, NOVEMBER 1969 - JUNE 1970
Jun. 1970 115 p refs
(Contract W-7405-eng-48)
(UCRL-20120) Avail: NTIS

Research at the Lawrence Radiation Laboratory is reported. This research covers primarily experimental and theoretical high-energy physics, but also atomic, statistical, plasma and health physics, accelerator theory and operation and development, and computing and data handling are considered. Lists of publications are included. NSA

N71-25742# Argonne National Lab., Ill.
FISSION-PRODUCT SPECTRA FROM FAST AND THERMAL FISSION OF U-235 AND Pu-239
K. A. Varteressian and Leslie Burris Mar. 1970 460 p refs
(Contract W-31-109-eng-38)
(ANL-7678) Avail: NTIS

The yields of fission-product nuclides in irradiated-uranium and plutonium, expressed as atoms per 100 atoms of U-235 or Pu-239 fissioned, were calculated, for both thermal and fast fission, as functions of irradiation time and cooling time. Fission-product yields are tabulated for irradiation and cooling times ranging from instantaneous to 10 years. Also included are tabulations of independent fission-fragment yields and of infinite-cooling-time stable fission-product yields. To make the numerous calculations possible, and to permit quick updating of data as new information on fission yields, half-lives, and decay schemes become available, computer codes known as DATAPREP and BURNUP have been developed. These, however, are by no means optimized at present and are included only as a matter of record. Author (NSA)

N71-25743# Chicago Univ., Ill.
DISPERSION THEORY AND CURRENT ALGEBRA
Yuk-Ming P. Lam (Ph.D. Thesis) Oct. 1970 70 p refs
(Contract AT(11-1)-264)
(COO-264-561; EFI-70-59) Avail: NTIS

Lorentz invariance and the basic assumption in dispersion theory that the matrix element of a retarded or advanced commutator of local fields is an analytic function of the energy variable, are seen to determine the method of handling the dispersion integral, and to require the matrix element to consist of terms, each being a product of at most two poles or integral thereof. This method is used to study current-algebra commutators with the consequence that the widely employed assumption of single-pole dominance for the spin-one parts of vector or axial-vector currents is inconsistent with current-algebra. Some aspects of the K sub 13 form factors are also discussed. Author (NSA)

N71-25744# Bureau of Mines, Washington, D.C.
IONIZED FIELDS IN ELECTROSTATIC SEPARATION: APPLICATIONS TO SECONDARY MATERIALS
Foster Fraas May 1971 16 p refs
(BMRI-7509) Avail: Issuing Activity

Calculations based on data related to the electrostatic precipitator illustrate the variation in the electric forces on a particle with change in position in the ionized field. The feeble forces in some separators are explained by the low field intensity at midpoint locations between the electrodes. When the particles are in contact with the exterior surface of a rotating cylindrical electrode, a high field intensity at the electrode surface combined with the image charge results in large electric forces. The permissible feed velocity increases as the square root of the electrode diameter, providing high values in efficiency and feed rate capacity, particularly in surface-to-mass ratio separations such as are encountered in secondary materials recycling operations. Author

N71-25749# Stanford Linear Accelerator Center, Calif.
STRUCTURE OF ELECTRON BUNCHES FROM AN INJECTOR WITH STEPPED VARIATION OF THE WAVE PHASE VELOCITY [STRUKTURA ELEKTRONNYKH SGUSTKOV INZHEKTORA SO STUPENCHATYM IZMENENIEM FAZOVOI SKOROSTI VOLNY]
V. A. Vishnyakov et al 1970 11 p refs Transl. into ENGLISH from Ukrainian report KHFTI-70-17 Sponsored by AEC
(SLAC-Trans-127; KHFTI-70-17) Avail: NTIS

Calculations and experimental data on the structure of bunches produced by an injecting section with a step change in the phase velocity of the wave are reported. It is shown that the output parameters of the 2 GeV electron linac can be improved by using an injector with a step change in the phase velocity of the wave. Author (NSA)

N71-25760# Columbia Univ., New York. Dept. of Chemistry.
ON THE ANGULAR DISTRIBUTION OF FISSION FRAGMENTS FROM THE Yb 170 COMPOUND NUCLEUS EXCITED TO 107 MeV
L. Kowalski, A. Zebelman, A. Kandil, and J. Miller Oct. 1970 7 p refs
(CU-1019-76) Avail: NTIS

The angular distributions of the fission products formed in the reaction of 126 MeV C-12 ions with Gd-158 and 137-MeV O-16 ions with SM-154, both of which give Yb-170 compound nuclei at an excitation of 107 MeV, were measured. It is found that the angular distribution in the C-12 ion entrance channel is proportional to (1/sin theta) from about 25 deg to 155 deg in the center-of-mass system while the corresponding range is about 15 deg to 165 deg for the O-16 ion entrance channel. The total fission cross sections are 20 + or − 2 mb and 39 + or − 4mb for the two entrance channels, respectively. Author (NSA)

N71-25781# Brookhaven National Lab., Upton, N.Y.
NUCLEON-NUCLEON INTERACTION AND THE AVERAGE NUCLEAR FIELD
V. V. Babikov Sep. 1970 29 p refs Transl. into ENGLISH of Russian report JINR-P4-4897 Presented at the 20th Conf. on Nucl. Spectry. and Struct. of the Nucleus, Leningrad, 1970
(BNL-tr-368; JINR-P4-4897) Avail: NTIS

The main trends and the latest achievements in nuclear forces theory are reviewed. Potential models of interaction in the two-nucleon system and in a heavy nucleus are considered. The role of the heavy mesons in creation of a self-consistent nuclear potential is analyzed. Statistical theories of nuclear matter distribution in finite nuclei are discussed. Author (NSA)

N71-25797# Oak Ridge National Lab., Tenn. Neutron Physics Div.
PHENOMENOLOGICALLY DETERMINED ISOBAR ANGULAR DISTRIBUTIONS FOR NUCLEON-NUCLEON AND PION-NUCLEON REACTIONS BELOW 3 GeV
Hugo Bertini, Miriam P. Guthrie, and Arline H. Culkowski 7 Dec. 1970 105 p refs Sponsored by AEC
(ORNL-TM-3132) Avail: NTIS

It was assumed that only the 3/2,3/2 isobar was excited and that it experienced s-wave decay in its own rest system. The entire range of mass values, consistent with conservation of energy, was assumed to be available to the isobars. The isobar angular distribution was constructed by first comparing experimental data with results from a calculation in which it was assumed that the isobar was created with an isotropic angular distribution. Then the same experimental data were compared with results from an identical calculation except that it was assumed that the isobar was created with a forward−backward distribution. Using different percentages of each distribution for different energies and incident particles, composite distributions were then formed by judgment in an attempt to obtain reasonable representations of the experimental data. Author (NSA)

N71-25813# Brookhaven National Lab., Upton, N.Y.
THE INTERMEDIATE BOSON. 1: TOTAL PRODUCTION CROSS SECTIONS IN HIGH ENERGY NEUTRINO AND MUON EXPERIMENTS
R. W. Brown and J. Smith (State Univ. of New York, Stoney Brook) 1970 68 p refs
(Contract AT(11-1)-1573)
(COO-1573-73; BNL-15170) Avail: NTIS

The theoretical total cross sections are presented for W-boson production in the reactions neutrino + Z yields Z + W + muon and muon + Z yields Z + W + neutrino for a variety of Z. The emphasis is on the energies and corresponding W-boson masses. The effects of the W's anomalous magnetic moment, the nucleon Fermi motion, the Pauli exclusion principle, inelastic channels (in particular, deep inelastic ones), and the problem of incoherent versus coherent production are all discussed. Also a critique of some recent high energy compilations is given. Author (NSA)

N71-25904*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SUPRATHERMAL PROTON BREMSSTRAHLUNG BY THE WEIZSAECKER-WILLIAMS METHOD

Frank C. Jones Apr. 1971 10 p refs Submitted for publication
(NASA-TM-X-65518; X-641-71-151) Avail: NTIS CSCL 20H

Suprathermal proton bremsstrahlung is a process in which the electron is initially at rest and the proton is moving. The cross section for suprathermal proton bremsstrahlung is calculated by the Weizsaecker-Williams method, and the results are shown to differ considerably from those of the conventional and much more difficult method. In particular, it is concluded that the suprathermal proton bremsstrahlung process cannot explain the 2 to 6 MeV gamma rays reported by Vette and others. Author

N71-25918# Argonne National Lab., Ill.

He-4/He-4 INTERACTION FROM LOW ENERGY SCATTERING PROCESSES AND STEP POTENTIAL MODELS [He4-He4 WECHSELWIRKUNG AUS STREUPROZESSEN BEI NIEDRIGEN ENERGIEN UND TREPPENPOTENTIALMODELLE]

Hans-Dieter Dohmann (Ph.D. Thesis – Bonn Univ., 1969) Dec. 1970 51 p refs Transl. into ENGLISH of German thesis
(ANL-Trans-872) Avail: NTIS

Experimental measurements of total cross sections for He-4/He-4 scattering are described in Part A of this three-part thesis. In part B the usefulness of a step-function model as a molecular interaction potential for calculation of cross sections is demonstrated. Certain rules for the approximation of realistic potentials by the model are given. Part C deals with a modification of the step potential model, which significantly reduces machine calculating time. Part B has been published and an abstract appeared as NSA 23: 14642. Parts A and C are to be published separately. NSA

N71-26037# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.

PROBLEM OF APPLICATION OF THE GALILEAN TRANSFORMATIONS IN QUANTUM MECHANICS

V. N. Streltsov 1970 5 p refs In RUSSIAN
(JINR-P2-5523) Avail: AEC Depository Libraries

The fact, that the wave function (when transforming to the other frame of references) acquires an additional phase in the Galilean approximation, is shown to be at variance with the relativistic formula of transformation psi'(x',t) = psi(x,t). Author (NSA)

N71-26038# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

ACCOUNT OF CORRECTIONS TO THE EIKONAL APPROXIMATION IN THE QUASIPOTENTIAL APPROACH

V. R. Garsevanishvili, S. V. Goloskokov, V. A. Matveev, L. A. Slepchenko, and A. N. Tavkhelidze 1970 14 p refs
(JINR-E2-5244) Avail: AEC Depository Libraries

The corrections to the eikonal approximation in the quasi-potential approach of the relative order 1/p as compared to leading contributions at high energies are studied. Author (NSA)

N71-26039# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

FACTORIZATION OF DUAL AMPLITUDES AND LOOPS IN THE COHERENT STATE MODEL

A. N. Kvinikhiodze, Kh. D. Popov, D. Ts. Stoyanov, and A. N. Tavkhelidze 1971 10 p refs
(JINR-E2-5568) Avail: AEC Depository Libraries

In the coherent state formalism with a finite set of five-dimensional oscillators, a factorization of the dual N-point amplitude with respect to the operators of these oscillators is proposed. A convergent expression for the planar one-loop diagram is obtained. Author (NSA)

N71-26048# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Physik-Institut.

PLASMATRON ION SOURCE FOR AN ELECTROMAGNETIC ISOTOPE SEPARATOR

H. Winter [1970] 14 p refs Presented at the 7th Intern. Conf. on Electromagnetic Isotope Separators and the Tech. of Their Appl., Marburg, West Germany, 7 – 10 Sep. 1970
(SGAE-PH-101/1970; CONF-700944-1) Avail: AEC Depository Libraries

A plasmatron ion source with slit geometry for the Seibersdorf electromagnetic isotope separator was developed; in its present state this ion source delivers well focused noble gas ion beams in the mA range at the collector. The influence of the various parameters on the properties of the plasmatron ion sources is discussed and a comparison with the usual ion sources of the low pressure arc type is made. It is shown that the plasmatron ion source may be superior for some applications in medium size laboratory isotope separators. Author (NSA)

N71-26049# Nuklearni Institut Jozef Stefan, Ljubljana (Yugoslavia).

COLD NEUTRON SOURCE EFFICIENCY IN A TANGENTIAL BEAM HOLE

V. Dimic and J. Petkovsek Nov. 1969 11 p refs
(IJS-571) Avail: AEC Depository Libraries

Cold neutron beam intensity has been measured for differently shaped moderator chambers at different positions in a 15 cm diameter tangential beam hole of the reactor Triga Mark II. Measurements have been performed at ambient temperatures. It has been found that the most favourable configuration for moderator is a black body scatterer with a gain factor 19 relative to the empty beam hole and 1.7 relative to 15 cm long graphite slab. The cold neutron source inserted into the tangential beam hole is described. Measurements of the gain factor for a graphite slab, methyl alcohol and methane are discussed. Author (NSA)

N71-26087*# National Aeronautics and Space Administration, Washington, D.C.

COMPILATION OF ULTRAVIOLET PHOTOABSORPTION CROSS SECTIONS FOR ATOMS BETWEEN 5 AND 3500 A

Robert D. Hudson and Lee J. Kieffer (NBS) 1971 61 p refs
(NASA-SP-3064) Avail: NTIS CSCL 20H

The compilation is limited to experimental measurements only and includes data for all atomic species that have been measured within the 5 to 3500 A energy range. A complete bibliography is not given; selection of the data was made on the basis of the inherent reliability of the measurement technique used in the determination. The data in the literature that have not been included in this compilation were rejected for one of two reasons: either the data were not the result of an absolute measurement, or other results existed that were obtained by more reliable methods. Author

N71-26201# Institute of Nuclear Research, Warsaw (Poland).

PERIODICITY OF SOME PROPERTIES OF LANTHANIDES AND ACTINIDES

J. Fidelis and S. Siekierski 1970 12 p refs
(INR-1212) Avail: AEC Depository Libraries

A summary of work on the regularities observed within the f-electron elements is presented. The regularities revealed first in the separation factor are a result of the particular variation of the standard free energy changes, Delta G(0), with for complex formation. In confirmation of general validity of the regularities, results of the review of an ample experimental material on the

stability constants for different ligands have been presented. The study has been extended on unit cell volumes, V, for different compounds. Two methods have been developed for studying the changes in both Delat G(0) and V, the separation factor method and the linear interpolation method. In a similar and V curves has been indicated. Three different forms of the periodic table of the f-electron elements were proposed. An attempt at explanation of this effect on the basis of a quantum mechanical study was undertaken. Author (NSA)

N71-26202# Illinois Univ., Urbana. Dept. of Physics.
INELASTIC e-p SCATTERING IN MASSIVE QUANTUM ELECTRODYNAMICS
P. M. Fishbane and J. D. Sullivan May 1971 11 p refs
(Grant NSF GP-25303)
Avail: Issuing Activity

Some calculations, in the deep enlastic region are made of the leading contributions in each order of perturbation theory for quantum electrodynamics with massive photons. Scaling is broken by factors which come from both transverse and longitudinal phase space integrations and which exponentiate in an elegant eikonal-like form. A number of interesting properties of the resulting expression are discussed. Author

N71-26203# Laboratoire de Physique Theorique et des Hautes Energies, Nice (France).
PURE STATES, POLARIZED TARGETS AND BARYON SPIN DETERMINATION
J. T. Donohue Feb. 1971 8 p refs Supported in part by CNRS
(N-TH-71/1) Avail: NTIS

A relation is found between the spin of a fermion resonance, the sum of the squares of statistical tensors, and the degree of target polarization for a given reaction on a polarized target. In principle, an unambiguous spin determination can be made by observing the parity-conserving decays of the resonance for two different values of the target polarization. Author

N71-26208# Syracuse Univ., N.Y. Dept. of Physics.
ON THE Q SQ DEPENDENCE OF THE INELASTIC e-p SCATTERING STRUCTURE FUNCTIONS
C. W. Gardiner (Waikato Univ.) and D. P. Majumdar 1970 31 p refs Sponsored by AEC
(SU-1206-236; NYO-3399-236) Avail: NTIS

It is pointed out that for omega = (2 M nu/Q sq) greater than or equal to 4.5 and Q sq less than 2 GeV sq, the structure function nu W2 (nu,Q sq) of the inelastic e-p scattering increases as Q sq increases at a fixed value of omega. To understand the Q sq dependence of the data, nu W2 is then analyzed from several theoretical points of view. In particular the parton model, the Regge pole model, and the field theoretical calculations are discussed. Author (NSA)

N71-26256# Forsvarets Forskingsanstalt, Stockholm (Sweden).
CALCULATION OF THE SO CALLED POWERFUL SUMMIT WINDS IN THE STRATUM BETWEEN 0-8 km AND 0-14km [BERAEKNING AV S K EFFEKTIVA HOEJDVINDAR I SKIKTEN 0-8 km OCH 0-14 km]
G. Lindblom Dec. 1969 25 p refs In SWEDISH
(FOA-4-C-4406-28) Avail: NTIS

The planning and investigation work with respect to the effects of a nuclear fallout against targets inside or around Sweden requires a meteorological basis for calculating the scale including among other things the probability of radioactive fallout. A study of approximately 5300 recordings of the wind at Bromma over a period of seven years is used to forecast wind data. Author

N71-26277 Virginia Univ., Charlottesville.
HIGH ENERGY GAMMA RAY ATTENUATION THROUGH SLABS OF CONCRETE, IRON AND LEAD
Daniel Harrison Risher, Jr. (Ph.D. Thesis) 1969 209 p
Avail: Univ. Microfilms Order No. 70-8089

Total and narrow beam geometry exposure ratios and buildup factors were obtained for a normally incident monodirectional gamma ray source. The spatial distribution of the exposure was also measured. The results in concrete and in iron at 6.47 MeV were found to compare well with moments and Monte Carlo calculations. At 8.23 MeV in iron and 6.47 MeV in lead, the experimental buildup factors were up to 15% higher than calculated. This difference increased to 30% at 8.23 MeV in lead. Electron production was shown to have a negligible effect on the total exposure. A comparison is also presented between the results of moments and Monte Carlo calculation. The effect of the neglecting of annihilation radiation in the moments calculation was evaluated and found to be about 4% in iron for an 8 MeV gamma-ray source. Differences between the moments and Monte Carlo calculations were attributed to a combination of the effect of annihilation radiation, and the use of different cross-sections in the two calculations. Dissert. Abstr.

N71-26278 Yeshiva Univ., New York.
THE INFINITE MOMENTUM LIMIT OF A SPINOR FIELD THEORY
David C. Flory (Ph.D. Thesis) 1969 126 p
Avail: Univ. Microfilms Order No. 70-11606

A self-contained theory of Dirac fermions interacting with (pseudo)scalar bosons at infinite momentum was constructed. The intermediate states which were eliminated are those containing particles moving away from the infinite momentum observer. The dynamical effect of these states is incorporated into a single counterterm in the interaction Hamiltonian. A complete set of generators of the Poincare group in a basis appropriate to the infinite momentum limit is demonstrated. These generators satisfy the commutator algebra of the Poincare group. In the context of the perturbation theory, the effect of the counterterm in the Hamiltonian is to produce a series of four-point vertices in the graphical representation of the perturbation expansion. A set of infinite momentum perturbation theory rules is given. In order to avoid the problems of renormalization a treegraph approximation is made throughout. Dissert. Abstr.

N71-26279 Syracuse Univ., N.Y.
FINITE FORMULATIONS OF FOUR-FERMION INTERACTIONS
Jagannathan Gomatam (Ph.D. Thesis) 1969 130 p
Avail: Univ. Microfilms Order No. 70-12776

Alternative formulations of a finite quantum field theory of interacting four-component spinor fields are presented for the interaction of four fermions. A theory based on the usual axioms of quantum field theory together with strong unitarity and strong Bogoliubov causality is developed which describes renormalizable spinor interactions. The Federbush model, a theory of interacting spin 1/2 particles in two dimensions, is discussed as an application. The four-fermion interaction in four-dimensional spacetime, which is non-renormalizable, is approached in two different ways: the finite formulation which employs higher order free-field equations and the generalized step functions in the framework of an indefinite metric Hilbert space. This theory, though mathematically satisfactory, is so far, at least, not fully amenable to physical interpretation. The finite formulation is a scattering operator theory, based on all the assumptions, except the notion of an interpolating field and uses a positive definite Hilbert space. This formulation is found to be mathematically and physically consistent for the example investigated. Dissert. Abstr.

N71-26286 California Univ., Riverside.
HYDRODYNAMICS OF A SUPERFLUID CONDENSATE

Jack Sachs Herold (Ph.D. Thesis) 1969 76 p
Avail: Univ. Microfilms Order No. 70-11986

Starting from the equation of motion for the first reduced density matrix describing a system of condensed bosons, a dynamical equation of motion is developed for the order parameter which couples to the noncondensate part of the first reduced density matrix. The derivation requires no assumptions concerning the strength of the potential nor is it limited to any particular temperature region. A detailed investigation of the coupling term gives an equation identical in form to one of the Landau-Ginzburg equations of superconductivity. Dissert. Abstr.

N71-26320# Naval Research Lab., Washington, D.C.
REPORT OF LINAC OPERATION Interim Report, 1 Jul.–31 Dec. 1970
T. F. Godlove Jan. 1971 28 p refs
(AD-720674; NRL-MR-2220; IR-11) Avail: NTIS CSCL 20/7

The operation and use of the NRL 60-MeV Linac is described for the period 1 July - 31 December 1970. Progress on the research program is discussed, including 180 degree electron scattering on 32S, 36A, and 40Ca. Slow neutron resonance data on rhenium isotopes have yielded interesting evidence for intermediate structure Calculations have been made justifying the so-called multiplicity method for obtaining s-wave resonance spins, and rough agreement has been found with data on six Hf, Nd, and Re isotopes. Total time for the six-month period was 2372 hours, divided into 1698 hours for beam and set-up time (including 77 hours for outside users), 600 hours devoted to maintenance and improvements, and 74 hours lost to breakdowns. References are included, as are brief descriptions of the use of the linac by other groups. Author (GRA)

N71-26323# Academy of Sciences of the Armenian SSR, Erevan (USSR) Inst. of Physics.
ON THE PHOTOPRODUCTION OF RHO-MESON(+) BY POLARIZED GAMMA-QUANTA IN RHO-MESON EXCHANGE PERIPHERAL MODEL
V. A. Shakhbazyan and K. M. Shakhbazyan 1969 17 p refs In RUSSIAN
(EFI-TF-6-69) Avail: AEC Depository Libraries

The gage-invariant generalization of the rho-meson exchange pole model is carried out. The differential cross section for the processes in the case of polarized gamma quanta is calculated. It is shown, that in a pole approximation, when gamma quantum polarization is perpendicular to the plane of reaction, the expressions depend only on one unknown parameter, the g factor of the rho and make possible the selection of its sign. Author (NSA)

N71-26324# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
CLASSIFICATION OF INELASTIC INTERACTIONS OF HIGH ENERGY PROTONS WITH NUCLEI. 2: CHARACTERISTICS OF LOW ENERGY PARTICLES
V. S. Barashenkov, A. S. Ilinov, N. M. Sobolevskii, and V. D. Toneev 1970 46 p refs In RUSSIAN
(JINR-P2-5549) Avail: AEC Depository Libraries

On the basis of the cascade-evaporative model, a detailed analysis of the low-energy component of secondary particles, produced in inelastic proton-nucleus collisions in the energy range from several dozens of MeV up to T approximately equal to 5 GeV, was performed. From the comparison of the calculation results with the experimental data, it follows that taking into account of the effect of the nonequilibrium particle emission is of great importance. The given calculation data allow one to determine, by interpolating, the corresponding characteristics for the intermediate energy values and the other nuclei. Author (NSA)

N71-26325# Jyvaskyla Univ. (Finland). Dept. of Physics.
EFFECT OF NONLOCALITY OF NUCLEON NUCLEON POTENTIAL ON THE TWO BODY SUM RULES Research Report
I. A. Lilja and R. M. K. Haemaelaeinen Dec. 1970 8 p refs
(NP-18648; PR-15/1970) Avail: AEC Depository Libraries

It is found that the effect of nonlocality of the nucleon–nucleon interaction can be easily transformed into the coordinate operator in connection with the sum rule calculations. NSA

N71-26335# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).
OPERATIONAL FORMULATION OF RESONANCE ABSORPTION OF NEUTRONS [FORMULACION OPERACIONAL DE LA ABSORSION RESONANTE DE NEUTRONES]
R. Paviotti Corcuera and R. Solenille 1970 24 p refs In SPANISH
(CNEA-266) Avail: AEC Depository Libraries

The use of operation calculations to obtain exact expressions for the resonance integral and intermediary resonance parameters is outlined. The expressions can be applied to the most general case of a heterogeneous system formed by a resonant absorbent mixed with N diluents and M moderators. The test functions for the fluxes are obtained by means of a linear approximation by the moderation operators. In this approximation the resonance parameters with physical significance are introduced. Three approximations are also given for the calculation of the resonance integrals which are directly applied to various resonances in homogeneous and heterogeneous systems. The three approximations are compared with Monte Carlo results. One of the approximations agrees very well with the Monte Carlo values. The general formulation given includes many of the I-R methods. Author (NSA)

N71-26336# Jyvaskyla Univ., Finland. Dept. of Physics.
PHASE-SPACE INTEGRAL AND STATISTICAL QUANTITIES IN HIGH ENERGY COLLISIONS
E. Suhonen Nov. 1970 11 p refs
(NP-18652; RR-14/1970) Avail: AEC Depository Libraries

Quantities which are analogous to the numerical flux and energy-momentum tensor in relativistic statistical mechanics are derived from the generating function of the phase-space integral for n particles. The average energy in the rest frame of the particle system is calculated using the definition of the average value given in terms of phase-space. Author (NSA)

N71-26337# Budapest Science Univ. (Hungary). Inst. for Theoretical Physics.
ENERGIES OF NUCLEI WITH DIFFERENT NEUTRON AND PROTON NUMBER IN THOMAS FERMI APPROXIMATION
J. Nemeth and E. Gadioli Erba Mar. 1970 10 p
(NP-18545; ITP-274) Avail: AEC Depository Libraries

The Thomas–Fermi method is applied to calculate the energies of nuclei with density-dependent effective forces. The terms of the semiempirical mass formula are determined. They are in good agreement with experiment. The neutron–proton density distributions are given for the mass range A = 50 to 240. In the same mass-number domain nuclei far off the beta-stability line are examined. Author (NSA)

N71-26340# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
MEASUREMENT OF NEUTRON FLUX BY THE FLUCTUATION METHOD
Yves Plaige, Christian Vaux, and Jean Lyscar Dec. 1970 68 p refs In FRENCH
(CEA-R-4119) Avail: AEC Depository Libraries

The method consists of measuring the variance in the neutron detector signal fluctuations. It is shown that if the distribution of neutron events obeys a Poisson law, then the variance in the fluctuating signal is proportional to the neutron flux (Campbell Theorem). Assuming that the statistical nature of the measurement principle is known the method will only be used in relatively intense flux (where the number of events is high) with in-core or out-of-core detectors. Its most important advantage is its enhanced power of discrimination between neutron flux and gamma radiation; a disadvantage is that the response time is long. The method is complementary to existing methods, but does not supersede them. The circuits developed and the various parts which constitute the new instrumentation are described. Author (NSA)

N71-26341# Kernforschungsanlage, Juelich (West Germany).
[ORGANIZATIONAL DEVELOPMENTS AND RESEARCH PROJECTS DURING 1969] Annual Report [BERICHT FUER DASJAHR 1969]
1969 256 p refs In GERMAN
(NP-18602) Avail: AEC Depository Libraries

The development and goals of the Juelich Nuclear Research Center in 1969 are reported. The general development of the research installation is outlined and the large projects, especially on the study of high temperature reactors, are briefly reported. The scientific and engineering devices and instrumentation developed are described. The scientific publications, internal reports, and contributions to meetings and conferences are tabulated. Work done in botany and microbiology, zoology and radioagronomy, medicine, physical chemistry, nuclear physics, solid-state and neutron physics, instruments and electronics, engineering physics, reactor construction elements, reactor materials (including hot cells), reactor development, and plasma physics is briefly summarized. NSA

N71-26342# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton. Rutherford High Energy Lab.
NIMROD OPERATION AND DEVELOPMENT Quarterly Report, 1 Apr.–30 Jun. 1970
D. E. Gray, ed. Sep. 1970 14 p
(RHEL/R-206) Avail: AEC Depository Libraries, UK 2s 6d

The Nimrod beam was on for high energy physics research for 89% of HEP scheduled operating time. Four experiments were completed and seven continued through this quarter. A heat pipe transport system which increases the operational effectiveness of liquid hydrogen targets is described. The development of wire grid electrodes in electrostatic separators, resulting in very large reductions in conditioning times coupled with lack of sensitivity to contamination, is reviewed. Some preliminary notes are given on resonant extraction system tests on X3, Nimrod's third extracted proton beam. Author (NSA)

N71-26344*# Washington Univ., St. Louis, Mo. Lab. for Space Physics.
NUCLEAR INTERACTION TRACKS IN MINERALS AND THEIR IMPLICATIONS FOR EXTRATERRESTRIAL MATERIALS
G. Crozaz, M. Hair, M. Maurette, and R. Walker May 1969 19 p refs
(Contracts NAS9-8165; Z80058T)
(NASA-CR-118658; SPP-17) Avail: NTIS CSCL 20H

The geometrical characteristics and the thermal stability of the interaction tracks produced by protons and alpha particles in mica are studied. The tracks are also studied in minerals which are found in meteorites or which are likely to be found in lunar materials. The energy and the fluxes of the ion were chosen to simulate exposures of > 1,000 years in the light component of the solar flare cosmic rays. Author

N71-26376# Kernforschungszentrum, Karlsruhe (West Germany).
PROPOSAL FOR A STANDARD SPECTRUM TO CHECK TECHNIQUES OF FAST NEUTRON SPECTRUM MEASUREMENTS
M. Kuechle and E. Wattecamps [1969] 14 p refs Presented at 11th EACRP Meeting, London, 12–14 Feb. 1969
(EACRP-L-74) Avail: AEC Depository Libraries

In order to allow a cross check of neutron spectra measurements in fast critical assemblies, a standard assembly is proposed. The assembly composition which is concluded to be the optimum for a standard spectrum is U with a 10% average enrichment moderated with polyethylene so that the atomic ratio of H to U is 0.15. NSA

N71-26377 California Univ., Berkeley.
NONLINEAR WAVE INTERACTION SPECTROSCOPY
Charles Vernon Shank (Ph.D. Thesis) 1969 122 p
Avail: Univ. Microfilms Order No. 70-13164

A type of laser spectroscopy for probing atomic systems using the nonlinear interaction between two running wave optical fields is discussed. Measurement of the frequency dependence of the nonlinear interaction allows determination of the homogeneous linewidth of a Doppler-broadened atomic transition. The dependence of the interaction on the angle between the planes of polarization of the two linearly polarized running waves provides information on atomic level degeneracies. Nonlinear wave interaction spectroscopy was applied to the helium-neon gas discharge system. Measurements of the homogeneous linewidth for the 6328 A line in neon and helium-neon gas discharges are presented. The wave interaction dependence on level degeneracy was demonstrated for the 6328 A in neon where $J=1$ for the upper level and $J=2$ for the lower level. An attempt was also made to apply wave interaction spectroscopy to study a semiconductor. Dissert. Abstr.

N71-26388 Brown Univ., Providence, R.I.
A STUDY OF THE BONDING OF NITROGEN BY NUCLEAR QUADRUPOLE RESONANCE SPECTROSCOPY
Robert Anthony Marino (Ph.D. Thesis) 1969 123 p
Avail: Univ. Microfilms Order No. 70-8757

The data are analyzed using the Townes and Dailey method of determining electronic populations from quadrupole coupling data. The effect of benzo group, amino group, and chlorine substitution on the electronic structure of the ring nitrogens in six-membered heterocyclic molecules was determined by studying three isomeric benzodiazines, five amino-substituted azines and three chloro-substituted azines. Data on azobenzene and another azo-compound are also presented. From results in five alkali and alkali earth nitrites, the magnitude of lattice effects on nuclear quadrupole coupling constants in ionic solids was determined. Data on methane sulphon-amide and methoxylamine are presented and analyzed together with previously reported data on three other inorganic amines also of formula NH_2R. The trends in the quadrupole coupling data are discovered to be due to both the polarization of the N-R sigma bond, and to the change in the three-dimensional arrangement of the NH_2R pyramid. Dissert. Abstr.

N71-26391# Commissariat a l'Energie Atomique, Limeil-Brevannes (France). Centre d'Etudes.
INVARIANCE LIE ALGEBRA AND GROUPS FOR THE NONRELATIVISTIC HYDROGEN ATOM [ALGEBRE ET GROUPE DE LIE D'INVARIANCE DE L'ATOME D'HYDROGENE NON RELATIVISTE]
Alain Decoster (Ph.D. Thesis) Dec. 1970 131 p refs In FRENCH
(CEA-R-4112) Avail: AEC Depository Libraries

A general survey of the use of Lie groups and algebras in quantum mechanics is made. An extensive description of the invariance algebra and invariance group for the nonrelativistic hydrogen atom is then given; the development of this group, discovered by Fock, is particularly examined. A bibliography

containing 200 references on the invariance groups and algebras of classical and simple quantum mechanical systems is given.
Author (NSA)

N71-26392 Maryland Univ., College Park.
MULTIPLE SCATTERING CALCULATIONS OF GAMMA PHOTON TRANSPORT
Sergio Cangiano (Ph.D. Thesis) 1969 179 p
Avail: Univ. Microfilms Order No. 70-11615

A solution method for the problem of three dimensional photon transport is developed. The method solves the Boltzmann equation by expanding the flux in a Neumann series such that the nth term represents the flux of photons which has undergone n collisions. A computer program, SCAT, was written in order to calculate the angular and energy spectra at different points in heterogeneous spherical media. The results were compared with moments method calculations by Goldstein and Wilkins. Buildup factors and number flux versus energy for various source energies and materials were calculated. Reasonable agreement was obtained.
Dissert. Abstr.

N71-26394# Jagellonian Univ., Cracow (Poland). Dept. of Theoretical Physics.
PHYSICAL BOUNDS FOR THE COMPONENTS OF STATISTICAL TENSORS
A. Kotanski, B. Sredniawa, and K. Zalewski May 1970 13 p refs
(TPJU-12/70) Avail: AEC Depository Libraries

Numerical values of the physical bounds for the components of single and double statistical tensors for spins < or = to 2 are calculated. The symmetry properties of these bounds are derived. Correlations between the values of different tensor components are not considered.
Author (NSA)

N71-26395# Commissariat a l'Energie Atomique, Grenoble (France).
EPR AND ENDOR STUDY OF FREE RADICALS PRODUCED BY GAMMA IRRADIATION OF IMIDAZOLE SINGLE CRYSTALS
Bernard Lamotte (Ph.D. Thesis) Nov. 1970 175 p refs In FRENCH
(CEA-R-3758) Avail: AEC Depository Libraries

Gamma irradiation of imidazole single crystals at 300 K gave two radicals. Identification and detailed studies of their electronic and geometric structure were made by ESR and ENDOR techniques. A study of the hydrogen bonded proton hyperfine tensor was made and showed the nonexistence of movement and tunneling of these protons. The principal low temperature radical produced by gamma irradiation at 77 K was also studied by ESR. A model is proposed.
Author (NSA)

N71-26396# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.
FAST NEUTRON SCATTERING MODELS, SLOWING DOWN AND FORMATION OF REACTOR SPECTRA
H. Kuesters Sep. 1970 41 p refs Sponsored by US-Euratom
(EURFNR-864; KFK-1295) Avail: AEC Depository Libraries

A review is presented covering the models of neutron slowing down calculations in both thermal and fast reactors. To understand the physical nature of the processes which form the reactor spectrum, slowing down is investigated in an infinite medium. The performance of space dependent calculations in homogeneous as well as in heterogeneous media is outlined.
Author (NSA)

N71-26397 State Univ. of New York, Stony Brook.
A PRIORI CALCULATION OF NUCLEAR SPIN COUPLING CONSTANTS
Alan Wilmot Douglas (Ph.D. Thesis) 1970 199 p
Avail: Univ. Microfilms Order No. 70-12466

A complete development of the theory of the interaction of nuclear spins with orbital and spin magnetic moments of the electron, which leads to expressions for various contributions to nuclear spin coupling observed in NMR spectra, is presented; numerical values of spin coupling through contact and dipolar mechanisms are calculated in a variety of molecules: CH4, C2H6, CH3F, C2H4, H2CO, C2H2, and HCN. Coupling constants are formulated in terms of expansions over excited state wavefunctions constructed by self-consistent-field and configuration interaction techniques. The effects of size and type of atomic basis sets and methods of treating excited states are examined. A basis of Gaussian lobe functions is used to expand atomic orbitals and uncertainties in orbital amplitudes as well as hydrogen scale factors.
Dissert. Abstr.

N71-26403# Commissariat a l'Energie Atomique, Grenoble (France). Centre d-Etudes Nucleaires.
STUDY OF POINT AND CLUSTER DEFECTS IN LiF BY PHONON SCATTERING [ETUDE DES DEFAUTS PONCTUELS ET ETENDUS DANS LiF PAR DIFFUSION DES PHONONS]
Karl Neumaier (Ph.D. Thesis) Nov. 1970 98 p refs In FRENCH
(CEA-R-4010) Avail: AEC Depository Libraries

Thermal conductivity measurements between 0.45 and 100 K were used to study point and cluster defects produced in LiF by doping or gamma irradiation. In particular, measurements relative to concentration of Mg and thermal treatments, were considered. The precipitation process from solid solution was studied for a sample with a concentration of 230,000. Numerical analysis and the Calleway model enabled the quantity and the number of precipitates to be determined. This quantity is remarkably well defined and depends only upon the annealing temperature. The results obtained for gamma-irradiated LiF are more complex. The results are interpreted, assuming the formation of interstitial fluoride in addition to the formation of F centers. A large decrease in thermal conductivity occurred with samples of pure LiF that had been heated to 800 C in a stream of water vapor; this phenomenon is attributed to resonant phonon scattering by the paraelectric OH(-) center.
Author (NSA)

N71-26404# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
PROCESSES OF THE TYPE OF DOUBLE CHARGE EXCHANGE AT LIGHT NUCLEI
A. V. Tarasov and Ch. Tseren 1970 14 p refs In RUSSIAN
(JINR-P2-5286) Avail: AEC Depository Libraries

The processes of double charge exchange of mesons at light nuclei are considered. It is shown that the cross sections of such processes contain, besides the cross sections of elementary acts occurring on nucleons, an important characteristic of the nucleon distribution in the nucleus (an average value of inverse square of the distance between nucleons) which, apparently, is sensitive to the nucleon pair correlations.
Author (NSA)

N71-26406 Texas A&M Univ., College Station.
A VARIABLE REDUCED MASS MODEL FOR QUASI-LINEAR MOLECULES WITH APPLICATION TO HSiBr
Norman Leroy Shinkle (Ph.D. Thesis) 1969 66 p
Avail: Univ. Microfilms Order No. 70-11582

A Hamiltonian for large amplitude bending and K-type rotation of tristomic molecules was derived. The complete dependence of the kinetic energy on the bending angle is included. The Hamiltonian contains two terms in addition to the usual two-dimensional isotropic harmonic oscillator Hamiltonian with a perturbing potential barrier. One of these terms is proportional to l squared. The effect of these large amplitude terms was determined by comparing

calculated energy levels with the levels of the two-dimensional oscillator with a barrier. A circular minimum potential has been determined for an excited state of the HSiBr radical. Dissert. Abstr.

N71-26408# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton. Computing and Automation Div.

COMPUTER GRAPHICS PATCHING OF FAILED CYCLOPS EVENTS FOR A SPARK CHAMBER EXPERIMENT

S. M. B. Bell Aug. 1970 38 p refs

(RHEL/R-205) Avail: AEC Depository Libraries; UK 7s

A system of programs is described for the rescue of spark chamber events in an experiment to test CP conservation. The events were measured on the Cyclops flying spot digitizer and subsequently fail in the automatic analysis system. Selected regions of the events are displayed on a computer-controlled CRT and faults in the pattern recognition processes of track-finding are repaired by an operator using a light pen. The results are subsequently replaced in the automatic system. Author (NSA)

N71-26422# Institute of Nuclear Physics, Krakow (Poland).

ELASTIC SCATTERING OF HIGH ENERGY HADRONS FROM DEFORMED C 12 NUCLEUS

H. Lesniak and L. Lesniak 1970 17 p refs

(INP-721) Avail: AEC Depository Libraries

Elastic scattering of high-energy protons from deformed C-12 nuclei is calculated using the multiple collision theory and deformed harmonic oscillator wave functions. Calculated differential cross sections are compared with the experimental data. Good agreement is found for the oblate deformation. Author (NSA)

N71-26423# Lyon Univ. (France). Inst. de Physique Nucleaire.

THE Fe-54 (d,alpha) REACTION AT 28 MeV [REACTION (d,alpha) SUR Fe-54 A 28 MeV]

A. Guichard, M. Chevallier, P. Gaillard, J.-Y. Grossiord, M. Gusakow et al Nov. 1970 21 p refs In FRENCH, ENGLISH summary

(LYCEN-7074) Avail: AEC Depository Libraries

Deuterons accelerated to 28 MeV were used to investigate the Fe-54(d,alpha) reaction. Angular distributions, for excitation energies up to about 4.5 MeV, were obtained. D.W.B.A. calculations were made on the basis of the Glendenning two-nucleon transfer theory. The results provide information about two-hole states of Mn-52. NSA

N71-26424# Atomic Weapons Research Establishment, Aldermaston (England).

THE (n,n' gamma) REACTIONS IN V 51 AND Y 89

D. Porter, R. E. Coles, and W. B. Gilboy (Surrey Univ.) Oct. 1970 39 p refs

(AWRE-O-78/70) Avail: AEC Depository Libraries; UK 5s 6d

A study of (n,n' gamma) reactions with V-51 and Y-89 for incident neutrons in the energy range 0.3 to 4 MeV is described. A 20-cc Ge(Li) spectrometer was used to detect de-excitation gamma rays following inelastic scattering from samples in ring geometry. In all, 33 transitions in V-89 were observed; and production cross sections for these gamma rays, at a mean angle of 100 deg, were derived as functions of incident neutron energy. Improved decay schemes, branching ratios, and level energies are presented and, where knowledge of these and appropriate gamma-ray angular distributions permits, comparisons with the predictions of Hauser–Feshbach theory modified for level width fluctuations are made. Spin assignments of recent work are confirmed, and possible assignments for the other levels observed are discussed. Author (NSA)

N71-26425# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

GRAPHICAL METHOD FOR THE DETERMINATION OF ALL RESONANCE PARAMETERS IN NUCLEAR REACTIONS

P. Beregi 1970 14 p refs

(JINR-E4-5456) Avail: AEC Depository Libraries

A method for the graphical determination of all parameters appearing in the generalized Breit–Wigner approximation for an isolated nuclear resonance is presented. Numerical examples are given for three different kinds of resonances of asymmetric form in the case of nonconstant background. Author (NSA)

N71-26445# Jagellonian Univ., Cracow (Poland). Dept. of Theoretical Physics.

EXAMPLES OF QUANTUM FIELD THEORIES WITHOUT DIVERGENCES

Jerzy Rayski May 1970 12 p refs

(TPJU-13/70) Avail: AEC Depository Libraries

The field concept is considered. Then the examples of a bounded interaction and of a temperate action are treated. (NSA)

N71-26446# Jagellonian Univ., Cracow (Poland). Dept. of Theoretical Physics.

AMBIGUITIES IN THE EXPERIMENTAL DETERMINATION OF RESONANCE PRODUCTION AMPLITUDES

P. Gizbert-Studnicki, A. Golemo, and K. Zalewski Feb. 1970 14 p refs

(TPJU-1/70) Avail: AEC Depository Libraries

Experiments with unpolarized particles determine only partially the scattering amplitudes. For reactions $0(-) + 1/2(+)$ yields $0(-) + 3/2(+)$ the most general transformation of the amplitudes, which leaves the experimental results unchanged, is given. Implications for the quark model are also discussed. Author (NSA)

N71-26447*# Washington Univ., St. Louis, Mo. Lab. for Space Physics.

COMMENTS OF A PAPER ON 'ELASTICALLY SCATTERED RECOIL NUCLEI IN SOLID STATE DETECTORS'

M. Maurette and R. M. Walker May 1969 16 p refs

(Contracts NAS9-8165; Z80058T)

(NASA-CR-118657; SPP-20) Avail: NTIS CSCL 20H

The use of elastically scattered recoil nuclei to measure the registration characteristics of solid state track detectors is discussed. To support this pictures of tracks, in mica, were attributed to elastically scattered K and Fe nuclei produced by an irradiation with 32 MeV O-16 ions. It is shown that the measured characteristics of the tracks do not match the theoretically predicted features for elastic processes and that the experimental features are consistent with those predicted for inelastic (mostly compound nucleus) reactions. The possibility that they are produced by contaminant ions present in the incident beam is not ruled out. Author

N71-26530# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

INVESTIGATION OF THE REACTION PROTON PROTON YIELDS PION(+) NUCLEON PROTON AT 650 MeV

R. Ya. Zulkarneev, S. V. Medved, V. S. Nadezhdin, B. M. Ovchinnikov, E. B. Ozerov et al 1971 19 p refs In RUSSIAN

(JINR-P1-5570) Avail: AEC Depository Libraries

Using the equipment consisting of H2(−) target, of a system of scintillation counters and of the filmless acoustic spark chamber on-line with the computer Minsk-22, the triple differential cross sections in the reaction proton proton yields pion(+) nucleon proton at 650 MeV were measured. The obtained experimental data are compared with the Sellery one-pion exchange model. Author (NSA)

N71-26545# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

ALGEBRAIC REALIZATION OF UNITARY SYMMETRY
V. I. Ogievetsky 1970 9 p refs
(JINR-E2-5229) Avail: AEC Depository Libraries

The algebraic realization of the SU (sub 3) symmetry is considered. The necessity of nonets is motivated. The mass sum rules derived are satisfied to a great accuracy for the well established supermultiplets providing new predictions for nonets in which not all the members are established to date. Author (NSA)

N71-28571# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
MEASUREMENT OF 4 PION BETA GAMMA COINCIDENCES IN THE RADIOACTIVITY METROLOGY LABORATORY. DESCRIPTION, PERFORMANCE, AND APPLICATIONS TO COMPLEX LEVEL SCHEMES. ACCURACY OBTAINABLE IN PARTICULAR CASES
Michel Laine, Jean-Pierre Perolat, Jacques Bouchard, and Yves Le Gallic Jan. 1971 81 p refs In FRENCH
(CEA-R-4131) Avail: AEC Depository Libraries

After describing the 4 pion beta-gamma coincidence unit, the different corrections are discussed for a simple decay scheme and then for the case of a complex decay scheme, paying particular attention to the correction terms peculiar to the unit. The different methods used to determine the gamma efficiency of the 4 pion beta detector were compared, and the practical aspects discussed. Several examples of complex decay scheme measurements are given (Sb-125, Fe-59, Ru-106 + Rh-106). The performance is discussed and suggests that an accuracy of 0.2 per cent is now feasible. Author (NSA)

N71-28573# Jyvaskyla Univ. (Finland). Dept. of Physics.
SIMULTANEOUS RECORDING OF TRUE AND RANDOM COINCIDENCES USING A TWO PARAMETER ANALYZER SYSTEM
J. Hattula and H. Helppi Jun. 1970 9 p refs
(NP-18614) Avail: AEC Depository Libraries

A description is given of a simple fast coincidence method which allows the simultaneous recording of coincidence and random coincidence spectra. The method is based on the properties of a standard two-parameter pulse-height analyzer system, and no special electronics is required. The method is tested in connection with angular correlation measurements. Author (NSA)

N71-28574# Institute of Nuclear Research, Warsaw (Poland).
LAMBDA-EXCITED STATES OF HYPERNUCLEI
A. Deloff and J. Pniewski 1970 13 p refs
(INR-P-1222) Avail: AEC Depository Libraries

Excited Lambda-states of hypernuclei by means of optical potential model are considered. A realistic Saxon - Woods potential is simulated by an equivalent square well potential. The positions of the levels are calculated in terms of the mass number A of the core nucleus. The spread in binding energies due to uncertainties in the value of parameters characterizing the optical potential is discussed. Author (NSA)

N71-28588# European Organization for Nuclear Research, Geneva (Switzerland).
COMPILATION OF CROSS SECTIONS. 1: PROTON INDUCED REACTIONS
J. D. Hansen, D. R. O. Morrison, N. Tovey, and E. Flaminio (Brookhaven Natl. Lab.) Oct. 1970 97 p refs
(CERN/HERA-70-2) Avail: NTIS

A compilation of cross sections of reactions produced by protons on targets of protons, neutrons, deuterons and helium is presented. Graphs of the variation of cross section with incident laboratory momentum are plotted. Values for the rate of decrease of cross section with incident momentum are given. NSA

N71-28587# Jyvaskyla Univ. (Finland). Dept. of Physics.
DIRECTIONAL CORRELATIONS OF SOME GAMMA RAY CASCADES IN Hg-200
J. Hattula, H. Helppi, and J. Kantele Sep. 1970 213 p refs
(NP-18613) Avail: AEC Depository Libraries

Directional correlation functions of 10 gamma-ray cascades in Hg-200 were measured using a Tl-200 source and a Ge(Li)–NaI(Tl) coincidence spectrometer arrangement. Values of the mixing parameter delta for several transitions are determined, and the spin assignments for the levels in Hg-200 are established. Author (NSA)

N71-28588# Jyvaskyla Univ. (Finland). Dept. of Physics.
NOTES ON QUANTUM MECHANICAL SUM RULES
I. A. Lilja and R. M. K. Haemaeleinen Sep. 1970 15 p refs
(NP-18619) Avail: AEC Depository Libraries

Sum rules for expressions of the form Sigma sub j(E sub j − E sub n) to the e-th power × (n/B/j) (j/A/n) are investigated. New derivations by using a simple and useful technique are given. Applications of the sum rules are given for an electric dipole operator and for the operator function e to the A-th power, where A is an antihermitian operator. Applicability of the sum rules in general is discussed. Author (NSA)

N71-28601# Jyvaskyla Univ. (Finland). Dept. of Physics.
REINVESTIGATION OF THE DECAY OF Tl-200
T. Komppa, A. Pakkanen, and J. Kantele Nov. 1970 18 p refs
(NP-18647; RR-13/1970) Avail: AEC Depository Libraries

A detailed study of gamma rays and gamma-ray cascades from 26.1-h Tl-200 was carried out employing Ge(Li) detectors, an anti-Compton spectrometer, and a Ge(Li) – NaI(Tl) coincidence spectrometer. A decay scheme is proposed which incorporates six new excited states in Hg-200. The energies and gamma-ray decay branching ratios of some of the levels are compared with values calculated from the model of Covello and Sartoris who describe Hg-200 as two proton holes coupled to surface vibrations. Author (NSA)

N71-28613# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
DELAYED NEUTRON EMISSION: EMISSION PROBABILITIES AND ENERGY SPECTRA [EMISSION DE NEUTRONS RETARDES PROBABILITES D'EMISSION ET SPECTRES D'ENERGIE]
Roland de Tourreil Aug. 1970 33 p refs In FRENCH
(CEA-N-1333) Avail: AEC Depository Libraries

The model used to describe the process starts from the negative beta decay of the precursor nuclide; then the excited nucleus obtained loses its energy by emission of gamma-rays or neutrons. The results obtained show, in particular, that the structure of the neutron energy spectra can be well reproduced together with the correct emission probabilities Pm. Author (NSA)

N71-28614# Central Research Inst. for Physics, Budapest (Hungary).
REMARKS ON A NEW FIT OF THE PARAMETERS FOR CABIBBO'S THEORY
A. Frenkel and P. Hasenfratz [1970] 7 p refs Presented at the Symp. on Hadron Spectroscopy, Balatonfured, Hungary, 6 – 11 Sep. 1970
(KFKI-70-23-HEP; CONF-700937-2) Avail: AEC Depository Libraries

Some of the theoretical uncertainties inherent in the theory of the weak interaction and their possible influence on the fitted value of the Cabibbo angle are discussed. Special attention is given to the problem of the q sq dependence of the form factors. Author (NSA)

N71-28629# Joint Inst. for Nuclear Research, Dubna (USSR).
THEORETICAL MODEL INDEPENDENT DETERMINATION

OF THE REAL PARTS OF THE K(+ −) PROTON FORWARD SCATTERING AMPLITUDES
O. V. Dumbrais, T. Yu. Dumbrais, and N. M. Queen 1970 33 p refs
(JINR-E2-5216) Avail: AEC Depository Libraries

A method of analyzing the experimental data on kaon-proton scattering is used to obtain an accurate determination of the real parts of the forward scattering amplitudes at moderate energies. However, unlike conventional dispersion relation calculations, it requires no assumptions about the residues of the hyperon pole terms and the amplitudes in the unphysical and asymptotic regions. The method can be used in principle to analytically continue the scattering amplitude from the physical region to the Lambda pole. However, a sufficiently accurate model-independent determination of the kaon neutron Lambda neutrinos coupling constant cannot be obtained in this way using the experimental data which exist at the present time. Author (NSA)

N71-26637# Lyon Univ. (France). Inst. de Physique Nucleaire.
PROJECTION METHODS AND THEIR APPLICATIONS TO HARTREE-FOCK WAVE FUNCTIONS
Mehdi Hage-Hassan (Ph.D. Thesis) Jun. 1970 81 p refs In FRENCH
(LYCEN-7050) Avail: AEC Depository Libraries

An attempt was made to use infinitesimal rotational projection operators in a calculation on the rotational band of deformed nuclei. A method of constructing these operators was developed; they were then associated with the destruction operators, which act as projectors in the case of axial symmetry. The use of these operators in rotational band spectra led to complicated calculations. A new method was subsequently introduced, which led to a simpler calculation. The method of Lowdin, the theorem of Thouless, and the moments of inertia calculated by Yoccoz and by Villard were recovered. A formula for calculating the elements of the rotational matrix on the basis of an axially symmetric harmonic oscillator was established. A program was written for calculating the energy and the Hartree−Fock wave function; and another program for calculating the rotational band spectrum using this method. The two programs may be used with a Series 1130, 8K IBM computer. Author (NSA)

N71-26655# Lyon Univ. (France). Inst. de Physique Nucleaire.
ADVANCE IN THE APPLICATION OF THE CROSS CORRELATION METHOD IN NUCLEAR PHYSICS [CONTRIBUTION A L'APPLICATION DE LA METHODE D'INTERCORRELATION EN PHYSIQUE NUCLEAIRE]
Michel Rotival (Ph.D. Thesis) Apr. 1970 67 p refs In FRENCH
(LYCEN-7032) Avail: AEC Depository Libraries

A theoretical study of the experimental method of cross correlation showed that the pseudo random pulse method, for identical measurement times and experimental conditions, led to a statistical accuracy which was much greater than that obtained by conventional time of flight methods. The experimental problems arising from the correlation method were studied and it was shown that they were insurmountable. NSA

N71-26657# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
THE PROGRAM IGOR. STRAIGHT LINE ATTENUATION: ADJUSTMENT OF THE ATTENUATION-NUCLEI IN SPHERICAL GEOMETRY [PROGRAMME IGOR. ATTENUATION EN LIGNE DROITE: AJUSTEMENT DU NOYAU D'ATTENUATION EN GEOMETRIE SPHERIQUE]
Michel Simon Jun. 1970 15 p refs In FRENCH
(CEA-N-1312) Avail: AEC Depository Libraries

The use of calculation codes dealing with neutron propagation according to a straight line attenuation model requires a knowledge of the displacement cross sections of each medium traversed. The program IGOR determines values of the displacement cross sections in spherical geometry from the flux which should be obtained at the media interfaces. An alternative makes it possible to provide a set of displacement cross sections and the program then calculates the flux at points chosen by the user. The program IGOR is written in FORTRAN 4 for the IBM 360. Author (NSA)

N71-26658# Gosudarstvennyi Komitet Po Ispolzovaniyu Atomnoi Energii, Obninsk (USSR). Fiziko-Energeticheskii Inst.
ANGULAR ANISOTROPY OF THE PHOTOFISSION OF Pu 239 [UGLOVAYA ANIZOTROPIYA FOTODELENIYA PLUTONIYA-239]
A. S. Soldatov, Yu. M. Tsipenyuk, and G. N. Smirenkin 1970 15 p refs In RUSSIAN
(FEI-190) Avail: AEC Depository Libraries

The energy dependence of the cross section and angular anisotropy of the photofission of Pu-239 was studied near the threshold. Also performed was combined analysis of experimental data on reactions of Pu-239(gamma,f) and Pu-238(n,f). The quasi-stationary state of the Pu-239 nucleus, fissioning at the excitation energy of 5.6 MeV, was found to be 0.5 MeV below the height of the barrier. Author (NSA)

N71-26659 Cornell Univ., Ithaca, N.Y.
TRANSVERSE PROPAGATION OF NEUTRON WAVES
Tomaz Ladislav Klinc (Ph.D. Thesis) 1970 74 p
Avail: Univ. Microfilms Order No. 70-12631

Cercignani's method of singular eigenfunctions is developed to study transverse propagation of one-speed neutron waves in a medium with isotropic scattering. A close relationship between this and the Case method is displayed. Cercignani's method can be applied to transport problems characterized by two-dimensional eigenvalue spectra. The half-space problem with the wave propagating along the surface is solved exactly. The complex extrapolated endpoint is determined from the asymptotic part of the solution. An expansion for the extrapolated endpoint is given in terms of two characteristic parameters. No closed-form solution is found for the slab problem. This problem, like the critical problem, is reduced to an integral equation which can be solved by iteration. The asymptotic distribution is determined in the zeroth-order approximation giving a complex transverse buckling. Dissert. Abstr.

N71-26667# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ANOMALOUS MAGNETIC MOMENT OF NUCLEONS
S. V. Goloskokov 1970 15 p refs
(JINR-E2-5333) Avail: AEC Depository Libraries

Self-consistent solution is received for the anomalous magnetic moment of the nucleon upsilon prime on the basis of the sidewise dispersion relations for upsilon prime and the dispersion relations for the pion nucleon scattering amplitudes. Author (NSA)

N71-26668# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON THE FRIEDMAN THEORY: ON THE ROLE OF GRAVITATION IN THE ELEMENTARY PARTICLE THEORY
M. A. Markov 1970 31 p refs In RUSSIAN Presented at the 15th Intern. Conf. on High Energy Phys., Kiev, Aug. 1970
(JINR-P2-5289; CONF-700806-29) Avail: AEC Depository Libraries

The work is based on the hypothesis that systems with external microscopic parameters (Friedman) are produced in time automatically independently of the initial and randomly large macroscopic values of these parameters. Friedman uses as a phenomenological model extensive elementary particles, avoiding the known difficulties of nonlocal theory. A detailed analysis indicates that during systematic descriptions of the elementary particles in the general theory of relativity the Friedman character of the system under consideration develops automatically. Author (NSA)

N71-26669# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

STUDY OF GEOMETRICAL ABERRATIONS OF QUADRUPOLAR LENSES IN GUIDING DEVICES OR FINITE-EMITTANCE BEAM MATCHING SYSTEMS: APPLICATION TO THE STUDY OF A MATCHING TRIPLET [ETUDE DES ABERRATION GEOMETRIQUES DES LENTILLES QUADRIPOLAIRES DES SYSTEMES DE GUIDAGE OU D'ADAPTATION DES FAISCEAUX D'EMITTANCE FINIE APPLICATION A L'ETUDE D'UN TRIPLET D'ADAPTATION]

Pierre Tanguy Dec. 1970 66 p refs In FRENCH
(CEA-N-1286) Avail: AEC Depository Libraries

It is shown that from a knowledge of the transfer matrix and aberrations coefficients of a quadrupole lens system, and the four-dimensional beam emittance at the entrance of the lens system, it is possible to obtain all the characteristic beam properties (beam cross section, density in the real plane, density in phase planes, etc.) at the end of the system. Quantitative results are given in relation to aberrations effects in matching system devices. Author (NSA)

N71-26670# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

ELECTRON PROBE MICROANALYSIS OF HIGHLY RADIOACTIVE MATERIALS: EQUIPMENT AND TECHNIQUES [ANALYSE A LA MICROSONDE ELECTRONIQUE DE MATERIAUX TRES RADIOACTIFS ETUDE DE L'APPAREILLAGE]

Jean Bazin, Claude Conty, Jacques Guernet, Michel Lauger-Hache, Achille Leleux et al Sep. 1970 34 p refs In FRENCH
(CEA-N-1340) Avail: AEC Depository Libraries

A shielded electron microprobe for samples with a maximum activity of 4 Ci at 0.75 MeV was designed and constructed. This equipment was developed from the CAMECA MS 46 microprobe in accordance with the following conditions: total security for operators (irradiation intensity at the surface of equipment lower than 2.5 mrad/h), and easy maintenance of the shielded microprobe. NSA

N71-26686# Lyon Univ. (France). Inst. de Physique Nucleaire.

DISTRIBUTION OF ION DENSITIES IN AN ARC DISCHARGE [SUR LA DISTRIBUTION DES CONCENTRATIONS IONIQUES DANS UNE DECHARGE D'ARC]

M. Bajard, G. Hadinger, G. Hadinger, and Th. Tauth 8 Jul. 1970 12 p refs In FRENCH
(LYCEN-7061) Avail: AEC Depository Libraries

The general equations of the elementary processes involved in the plasma are considered, and the characteristics of an arc discharge introduced. Quantitative relations between the concentrations of the ionic carriers and the different positive charges as a function of the j sub Z, Z sub m, (Z) and Z parameters, and the recombination and charge exchange cross sections, are obtained. The case of xenon is discussed, and cross sections calculated from the measured ion currents given. Author (NSA)

N71-26686# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Kernphysik.

EXCITATION FUNCTIONS AND DIFFERENTIAL CROSS SECTIONS FOR THE Be-9(N,ALPHA) REACTION WITH 8 TO 30 MeV NEUTRONS

L. Kropp and P. Forti Jul. 1970 21 p refs
(KFK-1190) Avail: AEC Depository Libraries

A new four parameter time of flight experiment (particle type and energy, neutron energy and emission angle) yielding differential cross section data of neutron induced reactions was performed. Energy distributions of alpha particles from the Be-9(neutrons,alpha) reaction were measured at several angles for neutron energies ranging from 8 to 30 MeV. Angular distributions and excitation functions for the three lowest states of He-6(ground state, 1.7 and 3.4 MeV) are evaluated. Author (NSA)

N71-26687 New Hampshire Univ., Durham.

ONE-CENTER EXPANSION WAVE FUNCTIONS AND THE HELLMANN-FEYNMAN THEOREM

James Joseph Eberhardt (Ph.D. Thesis) 1970 92 p
Avail: Univ. Microfilms Order No. 70-11808

One-center expansion wave functions (OCE-WF's) of multiconfigurational type are used to compute internuclear forces for the hydrogen molecule. A comparison is made between the force values computed from the slope of the total energy curve and those forces predicted by the Hellmann-Feynman electrostatic theorem (HFET) in order to ascertain the reliability of the forces computed from the latter when an approximate wave function of the OCE type is used. The results show that OCE-WF's do satisfy the HFET without need of floating parameters if the floating three restrictions are observed. (1) The coordinate system must be chosen such that the kinetic energy part of the Hamiltonian is independent of nuclear coordinates (internuclear distance). (2) The OCE approximate wave function must be fully optimized with respect to all of the basis function parameters included in the wave function. (3) The basis functions used to construct the wave function must exhibit no explicit dependence upon nuclear coordinates. Dissert. Abstr.

N71-26693# European Organization for Nuclear Research, Geneva (Switzerland).

ATLAS OF PARTICLE PRODUCTION SPECTRA

H. Grote, R. Hagedorn, and J. Ranft (Leipzig Univ.) 1970 116 p refs
(NP-18660) Avail: AEC Depository Libraries

An atlas of momentum spectra of secondary particles produced in p + p below 800 GeV/c and proton reactions with nuclei below 70 GeV/c is presented. The calculations are based on the thermodynamic model. NSA

N71-26694# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Nazionali di Frascati.

SHORT RANGE DYNAMICAL CORRELATIONS FROM ELASTIC AND QUASIELASTIC SCATTERING OF HIGH ENERGY ELECTRONS

A. Malecki and P. Picchi 16 Oct. 1970 6 p refs
(LNF-70/47) Avail: AEC Depository Libraries

The influence of short-range correlations on elastic and quasi-elastic electron scattering on He-4 is compared. Author (NSA)

N71-26696# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

STRAIGHT LINE PARTICLE PATHS APPROXIMATION FOR DESCRIPTION OF HIGH-ENERGY HADRON SCATTERING IN QUANTUM FIELD THEORY

B. M. Barbashov, S. P. Kuleshov, V. A. Matveev, V. N. Pervushin, A. N. Sissakian et al 1970 24 p refs
(JINR-E2-5217) Avail: AEC Depository Libraries

The problem of an asymptotic behavior of high-energy elastic and inelastic process amplitudes is studied by means of the functional integration methods in quantum field theory. The straight-line particle path approximation permitting effective calculation of available functional integrals is formulated. The closed relativistic invariant expression for both elastic and inelastic scattering amplitudes are obtained in the scalar nucleon-vector meson interaction model. Author (NSA)

N71-26697# Institute of Nuclear Physics, Karkow (Poland)

COMPARISON OF THE KAON/PION RATIO IN MULTIPLE PRODUCTION AT ENERGIES 60 GeV AND DIFFERENCE 1000 GeV

J. Babecki and B. Furmanska 1970 8 p refs
(INP-718) Avail: AEC Depository Libraries

In 200 jets with N sub h < or = 5 originated by 60-GeV pions from the Serpukhov accelerator, and in 203 cosmic-ray jets with energies approximately 100 GeV found in nuclear emulsion, the identification of relativistic secondary particles emitted at the angles > or = 20 deg and of grey tracks was performed. It was found that in the region of large normalized longitudinal momenta the K/pion ratio is equal 1.50 + or - 0.62 for high energy cosmic-ray jets and only 0.24 + or - 0.10 for accelerator jets. Author (NSA)

N71-26698# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. for Theoretical Physics.

ELECTROMAGNETIC TRANSITIONS FROM THE COMPOUND STATES IN DEFORMED NUCLEI

V. V. Voronov and V. G. Soloviev 1971 16 p refs In RUSSIAN
(JINR-P4-5562) Avail: AEC Depository Libraries

The matrix elements for the Elambda and Mlambda transitions from the high-lying states to the ground, two-quasi-particle, and one-phonon states of even deformed nuclei and to the one-quasi-particle and more compound states of odd deformed nuclei were obtained. The matrix elements of the E lambda and M lambda transitions are necessary for studying the structure of high-lying states. Author (NSA)

N71-26699# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.

INVESTIGATION OF T = 0 EXCITED STATES OF He 4 USING THREE-PARTICLE REACTIONS

E. L. Haase, R. Hagelberg, W. N. Wang, E. K. Lin, D. P. Saylor et al Aug. 1970 31 p refs Presented at Joint Spring Meeting of the Nucl. Phys. Sect. of the Ger. and Dutch Phys. Soc., Eindhoven, Netherlands, Apr. 1970
(KFK-1055; CONF-700417-2) Avail: AEC Depository Libraries

Using 52 MeV deuterons and 104 MeV/alpha particles coincidence measurements in three entrance channels were carried out for the following reactions: He-4(d,d prime t)H-1, He-4(alpha, alpha prime t)H-1, Li-6(d, alpha prime t)H-1, He-4(alpha, alpha prime He-3)n, Li-6(d, alpha prime He-3)n, He-4(d, d prime d)D, He-4(alpha, alpha prime d)D, and Li-6(d, alpha prime d)D. In measuring the correlations, the detector of the inelastic particle was kept at a fixed position and the second detector scanned over a range of coplanar angles favoring He-4 final state interactions. The data can be fitted consistently with six T = 0 excited states of He-4, at 20.2 MeV, 21.1 MeV, 21.9 MeV, 25.5 MeV, 28.5 MeV, and 31.8 MeV with widths of 0.2 MeV, 0.8 MeV, 1.8 MeV, 2.9 MeV, 5.3 MeV and 5.6 MeV respectively. The validity of the sequential reaction mechanism is examined. The internal consistency of the level parameters for the three entrance and three decay channels as well as the symmetry of the extracted angular correlations about 0 and 90 deg in the recoil system (center of mass) agree very well with the model of sequential decay. The angular correlations agree well with the predictions of a simple theory using the impulse approximation. Author (NSA)

N71-26700# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.

INVESTIGATION OF THE ELASTIC SCATTERING OF 104 MeV alpha PARTICLES He3 [UNTERSUCHUNG DER ELASTISCHEN STREUUNG VON 104 MeV alpha-TEILCHEN AN HE 3]

W. Fetscher, K. Sattler, N. C. Schmeing, E. Seibt, and Ch. Weddigen Jul. 1970 18 p refs In GERMAN; ENGLISH summary
(KFK-1204) Avail: AEC Depository Libraries

The differential cross section for the elastic scattering of He-3 104 MeV alpha particles on He-3 was measured and a double scattering experiment was prepared to determine the spin-orbit term of the optical potential. The differential scattering cross section shows a wide absorption minimum at theta sub CM = 100 deg. The decline at forward angles can be explained qualitatively by an optical potential. The backwards peaking presumably results from neutron exchange. A partial wave analysis according to strong-absorption-model gives about 50% absorption for 1 < = 4 purely elastic scattering for 1 > 6. The experimental setup for making polarization measurements was tested by double scattering of alpha particles on He-4. Author (NSA)

N71-26702# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

TOTAL SUMMATION OF PERTURBATION SERIES AT HIGH ENERGIES AND DIFFRACTION SCATTERING

V. M. Budnev, A. V. Efremov, I. F. Ginzburg, and V. G. Serbo 1970 28 p refs Presented at the 15th Intern. Conf. on High Energy Phys., Kiev, USSR
(JINR-E2-5509; CONF-700806-56) Avail: AEC Depository Libraries

It is shown, that the introduction of spin leads to an essential change in the structure of the j-plane and in the behavior of the amplitudes off the mass shell. The reason for this is a singular character of the interaction at small distance. High-energy summation of the all, logarithmic terms of all the diagrams in pseudoscalar mesodynamics, gives a new representation for the scattering amplitudes. In addition to the moving Regge poles, there appears a standing singularity. In the case of finite renormalization of the coupling constant and the wave function, it is a square root branch point, the position of which is determined by the bare coupling constant. The amplitudes do not vanish with the growth of external mass. The conspiration of pion and pion sub c-trajectories and the proportionality of the residue of the Regge trajectories in meson-baryon and baryon-baryon scattering to their position j = alpha (t) are discussed as well as the dips in the angular distributions when alpha(t) = 0. Author (NSA)

N71-26705# Lyon Univ. (France). Inst. de Physique Nucleaire.

PRODUCTION OF MULTICHARGED IONS IN A REFLEX SOURCE WITH AXIAL EXTRACTION [PRODUCTION D'IONS MULTICHARGES DANS UNE SOURCE REFLEX A EXTRACTION AXIALE]

M. Bajard, A. Chabert, M. Droc, G. Hadinger, G. Jacquet et al 23 Jul. 1970 16 p refs In FRENCH
(LYCEN-7065) Avail: NTIS

A test bench for reflex sources is described, and the first experimental results with an axial extraction source are given. Various extraction geometries were tested and a diaphragmed expansion cup was selected. The measurements were made with this cup. The internal and external characteristics of the nitrogen, neon, and argon ion sources are discussed. Currents composed of quadruply ionized particles were easily detected. Author (NSA)

N71-26706# Commissariat a l'Energie Atomique, Saclay (France). Centre d-Etudes Nucleaires.

INFLUENCE OF COUPLING RESONANCES 2 nu SUB z + OR - nu SUB X = INTEGER ON MECHANISM OF THIRD RESONANCE EJECTION [INFLUENCE DES RESONANCES DE COUPLAGE 2 nu SUB z + OU - nu SUB X = ENTIER SUR LE MECANISME DE L'EJECTION RESONNANTE TIERS]

G. Leleux Feb. 1970 23 p refs IN FRENCH
(NP-18517) Avail: AEC Depository Libaries

Since in the process of ejection there can be considerable increase in the vertical emittance, a study of the coupling resonances 2 nu sub z + or - nu sub x equals integer taking into account with greater precision the energy dispersion the beam. For simplification, the variation of hexapolar forces as a function of particle energy is not considered. The cumulative mechanism leading to an increase of the vertical emittance is discussed. (NSA)

N71-26707# Central Research Inst. for Physics, Budapest (Hungary).

GRACE: A MULTIGROUP FAST NEUTRON SPECTRUM CODE

Z. Szatmary and J. Valko [1970] 40 p refs
(KFKI-70-14-RPT) Avail: AEC Depository Libraries

GRACE is a multigroup fast neutron spectrum code which solves the asymptotic neutron transport equation in slab geometry using the Greuling-Goertzel approximation for the slowing down neutron source. The code permits the use of both B sub 1 and P sub 1 approximations. In the multigroup structure of GRACE a thermal group was included making an iteration to criticality of the slab possible. Author (NSA)

N71-26708# United Kingdom Atomic Energy Authority, Culham (England).

SINGLE PARTICLE MOTION IN AXISYMMETRIC SYSTEMS HAVING A TOROIDAL ELECTRIC FIELD

A. Gibson and C. M. Wilson Jul. 1970 6 p refs Prepared in cooperation with Tex. Univ., Austin
(CLM-R-105) Avail: AEC Depository Libraries; HMSO 1s 2d; BIS $0.30

Guiding-center computations confirm that a parallel electric field gives rise to an enhanced radial drift of blocked particles. The computations also show that the electric field can unblock the particles and so terminate the drift. Author (NSA)

N71-26710# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.

INVESTIGATION OF THE REACTION Li-7(d,n) Be-8

G. M. Osetinskii, B. Sikora, Ya. Tyke, and B. Fryshchin 1970 17 p refs In RUSSIAN
(JINR-P15-5143) Avail: AEC Depository Libraries

The differential cross sections and angular distributions of the neutrons from the reactions Li-7(deuteron, neutron sub 0)Be-8 and Li-7(deuteron, neutron sub 1)Be-8 resonance were measured in the deuteron energy range of 1.1 to 4 MeV. The total cross sections were obtained for the reaction Li-7(deuteron, neutron sub 0)Be-8 at six energy values. It is established that the reaction proceeds through the compound nucleus mechanism; the neutron spectra indicate the existence of 4.5 + or - 0.15 MeV level in Be-8 nucleus and the absence of other Be-8 nucleus levels in the range of the excitation energies up to 9 MeV. Author (NSA)

N71-26711# Kernforschungszentrum, Karlsruhe (West Germany).

A FAST REACTOR LATTICE EXPERIMENT FOR INVESTIGATION OF k INFINITY AND REACTION RATE RATIOS IN SNEAK, ASSEMBLY 5

B. Boehme, K. Boehnel, R. Boix-Amat, R. Eberle, E. Korthaus et al Jun. 1970 56 p refs Presented at the IAEA Meeting of Specialists on the Value of Plutonium Alpha, Winfrith, Engl., 30 Jun. - 1 Jul. 1969 Sponsored by US-EURATOM Fast Reactor Exchange Program
(EURFNR-861; KFK-1176; Conf-690654-1) Avail: AEC Depository Libraries

A fast reactor lattice experiment was carried out in the zero-power facility SNEAK to determine k infinite and reaction rate ratios. The test zone contained platelets of mixed PuO2 UO2, depleted and natural U metal, and graphite as a moderating material. Its composition was chosen to render a k infinite close to unity. The k infinite-values of systems with different C/U-238-ratios were determined by voiding a central region of the test zone and measuring the associated reactivity change. Fission rates of U-235 and U-238 inside the lattice cell were measured with solid state track detectors, the U-238-capture rate by activation of depleted uranium foils and subsequent gamma-X-ray coincidence counting. The experimental results are compared with 26 group calculations using different methods and cross section sets. Author (NSA)

N71-26714# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

QUANTUM THEORY BY THE PIONCARE GROUP

Kh. Ya. Khristov 1970 55 p refs In RUSSIAN
(JINR-P2-5513) Avail: AEC Depository Libraries

A quantum mechanics and a quantum field theory are considered where the wave functions and the field operators depend not on the 4 coordinates in the Minkovski space M but on all 10 variables determining the inertia frames of reference. The difference is that metrics in the space P invariant in respect to (t,l) yields (s,h)(t,l)(0,k) (1) are introduced. With this, the metrics are determined up to two constants (to be found by experiment). As an example one writes and solves the equation in P, analogous to the Klein-Gordon equation in M. Further, the second quantization of this equation is given by writing the equation for the commutator, invariant in respect to (1). It was not completely solved, but it is clear that the local commutativity holds. The aim is to get nontrivial models of interaction field theories by making larger the set of solutions. Author (NSA)

N71-26715# Central Research Inst. for Physics, Budapest (Hungary).

SL(2,C) REPRESENTATIONS IN EXPLICITLY ENERGY DEPENDENT BASIS. 2

K. Szego and K. Toth [1969] 15 p refs
(KFKI-70-19-HEP) Avail: AEC Depository Libraries

A systematic treatment is presented for the transformation matrix elements between different types of basis sets in the SL(2,C) representation space and for the boost matrix elements. The treatment is based on the theory of invariant bilinear functionals and makes use of the knowledge of explicit basis functions. New expressions are given for overlap functions, and it is shown, that they can be considered as Fourier-transform of a function, which is also known. Some relations are proved between boost functions and transformation matrix elements. A new and relatively simple expression is derived for the boost matrix elements in SU(2) basis. Author (NSA)

N71-26716# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

DOSE CHARACTERISTICS OF PROTONS WITH ENERGY 200 MeV

M. Zel'chinskii, S. Pshona, M. M. Komochkov, B. S. Sychev, and A. P. Cherevatenko 1970 16 p refs In RUSSIAN
(JINR-P16-5383) Avail: AEC Depository Libraries

The dose characteristics of protons with energy 200 MeV are found experimentally by recombination methods for which there are detailed theoretical calculations. The absorbed dose rate, related to unit density proton flux (P) and quality factor (QF) at the depth 5 cm in an infinite tissue-equivalent slab 30 cm thick for the case of normal irradiation with a broad parallel monoenergetical proton beam are taken as compared parameters. The values P = 81 + or - 8 nrad · prot/1 sq cm and QF = 1.40 + or - 0.25 rem/rad, obtained experimentally, testify that theoretical calculations have been based on the right assumptions with respect to cross section values and model of interaction process. Author (NSA)

N71-26717# Central Research Inst. for Physics, Budapest (Hungary).

SPIN TEST FOR A FERMION (J > 1/2) DECAYING INTO A SPIN-1/2 FERMION (NEUTRAL LAMBDA HYPERON) + A SPIN-1 PHOTON

S. Krasznovszky [1970] 7 p refs
(KFKI-70-27-HEP) Avail: AEC Depository Libraries

The decay of a fermion of arbitrary spin into an unstable spin-1/2 fermion (neutral Lambda hyperon) plus a photon is treated with density-matrix techniques and helicity formalism of Jacob and Wick. A complete determination of the multipole parameters of the parent fermionn is possible only in terms of the particle, and polarization, angular distributions of the decay hyperon (natural Lambda hyperon). Author (NSA)

N71-26718# Institute of Nuclear Research, Warsaw (Poland).
ON THE RESIDUAL INTERACTION OF PAIRING AND QUADRUPOLE PAIRING TYPE
W. Stepien-Rudzka 1970 12 p refs Submitted for publication
(INR-P-1215) Avail: AEC Depository Libraries

The residual two-body interaction is investigated. The new term is added to the standard pairing force, and its influence on the single-particle excitation spectra in heavy nuclei (transuranic region) is examined with special attention given to the behavior of so called energy gap, a typical parameter in spectra of even–even nuclei. Author (NSA)

N71-26719# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.
INVESTIGATION OF PARTICLE BEAM WITH ENERGY UP TO 70 GeV WITH A SPARK SPECTROMETER
I. A. Aleksandrov, V. N. Bolotov, M. N. Devisheva, M. I. Devishev, V. V. Isakov et al 1970 22 p refs In RUSSIAN
(IFVE-SEF/OP-70-13) Avail: AEC Depository Libraries

A magnetic spark spectrometer installed in a particle beam is described for searching for quarks. The measurement results of the beam parameters and comparison with calculations are reported. Differential cross-sections of negative production by protons on Al nuclei are derived. Author (NSA)

N71-26723# Central Research Inst. for Physics, Budapest (Hungary).
QUANTITATIVE AUTORADIOGRAPHY OF Zr-T PARTICLES
J. Biro and I. Feher [1970] 6 p refs (KFKI-70-26-HP) Avail: AEC Depository Libraries

The danger of tritium gas incorporation during the use and preparation of Zr–T targets for neutron production was investigated by the quantitative autoradiography of Zr–T particles. The active particles from the Zr–T targets were collected on membrane filters; the membrane filters were placed on a polyethylene foil and covered with radiographic emulsion. The activity change of the Zr–T particles with the diameter as the dark spots in the radiogram was measured, and the particle diameter was determined in dependence on the dark spot diameter. The activity size distribution and the activity median diameter were determined from these measurements. NSA

N71-26724# Japan Atomic Energy Research Inst., Tokyo.
JAERI FAST REACTOR GROUP CONSTANTS SYSTEM, PART 2
Satoru Katsuragi, Yukio Ishiguro, Hideki Takano, and Masayuki Nakagawa Dec. 1970 120 p refs
(JAERI-1199-Pt-2) Avail: AEC Depository Libraries

Improvements were made for the treatment of effective cross sections of heavy nuclides in the resonance energy region, and fast reactor group constants in this energy region were produced for nuclides U-235, U-238, Pu-239, and Pu-240. These group constants are thought to be accurate compared with existing fast group constants in the following sense: The resonance parameters (including those in the unresolved resonance energy region) are evaluated so as to fit measured cross sections. Accurate cross sections are obtained by a calculating procedure which uses a reasonable representation of cross sections without waste of computing time. The effective cross sections are obtained using exact spectra as weights, because conventional approximation methods yield less accurate results. An investigation was made for the treatment of interference effects. And interference effects with U-238 is taken into account for shielding factors. Author (NSA)

N71-26728# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. for Nuclear Problems.
CROSS SECTION OF ANTIKAON DEUTERON YIELDS KAON Y1 Y2
L. I. Lapidus, A. V. Tarasov, and Ch. Tseren 1970 9 p ref In RUSSIAN
(JINR-P2-5231) Avail: AEC Depository Libraries

The interactions of antikaons mesons with nuclei which generate hyperon and meson pairs, are currently widely investigated; therefore, their cross section is of great general interest. The study indicated that the cross section of the antikaon deuteron yields kaon Y1 Y2 is related in a simple manner to the cross section of single collisions of elementary particles with nucleons. The problem was examined on the basis of the pion chain in the antikaon deuteron yields kaon Y1 Y2 (antikaon deuteron yields pion Y1 N2 yields Kaon Y1 Y2) reaction. The derived expression leads directly to a formula obtained in a previous paper on the interaction of antikaon mesons with nuclei. NSA

N71-26729# Central Research Inst. for Physics, Budapest (Hungary).
HIGH STABILITY APPARATUSES TO INVESTIGATE THE ANGULAR DISTRIBUTION OF CHARGED PARTICLES OF ENERGIES 10 TO THE 13TH POWER TO 10 TO THE 14TH POWER eV IN THE GALAXY TOGETHER WITH AN INVITATION TO EXTEND THE MEASUREMENTS IN QUESTION TO ALL DIRECTIONS OF THE CELESTIAL SPHERE
J. Koch, J. Kota, A. Somogyi, I. Szuecs, G. Thaler et al [1970] 8 p refs Presented at the 6th Interam. Seminar on Cosmic Rays, La Paz, Bolivia, Jul. 1970
(KFKI-70-21-HEP) Avail: AEC Depository Libraries

Two sets of apparatus designed to study the angular distribution of primaries of energies 10 to the 13th power to 10 to the 14th power eV in the Galaxy are described in detail. One of them is an extensive air shower detector of conventional design with Geiger–Muller counters covering extremely large areas; the other is an EAS detector consisting of a combination of G–M counters and scintillators allowing the directions of EAS axes and high energy primaries to be determined individually with a high repetition rate. Both sets of apparatus were set up and are running in the northern hemisphere. An invitation was extended for other research groups to join the project and to build similar instruments near the equator and in the southern hemisphere so as to extend measurements to all directions of the celestial sphere. Author (NSA)

N71-26730# Joint Inst. for Nuclear Research, Dubna (USSR).
PROGRESS IN CREATION OF THE ACCELERATING SECTION OF A RINGORTRON (KOLSTETRON)
N. G. Anishchenko, N. I. Balalykin, V. A. Vasilev et al 1970 12 p refs In RUSSIAN Presented at the 2nd All Union Conf. on Charged Particle Accelerators, Moscow, 1970
(JINR-P9-5488) Avail: AEC Depository Libraries

Some questions connected with the creation of the cryogenic high frequency accelerating system of a ringotron are considered. The data on the behavior of the superconducting layer of cavities in the external magnetic fields of 20 kG are presented, and equipment for producing the layers is described. Data on superconducting solenoids are given as well as the scheme of the system of the sections. The problems of energy supply of solenoids and energy evacuation are discussed. Author (NSA)

N71-26731# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
ELECTRONUCLEAR METHOD OF NEUTRON GENERATION AND FISSILE MATERIAL PRODUCTION
R. G. Vasilkov, V. I. Goldanskii, V. P. Dzhelepov, and V. P. Dmitrievskii 1970 21 p refs In RUSSIAN; ENGLISH summary
(JINR-P9-5285) Avail: AEC Depository Libraries

The possibility of applying the electronuclear method of free neutron production to nuclear power technology is considered from the most general standpoint. The method is based on the fact

that heavy atomic nuclei emit many neutrons when absorbing protons (deuterons) accelerated to high energies. A brief review of the relevant experimental evidence, concerning neutron emmission by highly excited nuclei and electron multiplication in targets, is given; and some known designs of electronuclear facilities based on proton and/or deuteron accelerators with beam powers up to 100 MW are discussed. The main difficulties in developing high current accelerating systems, capable of providing currents sufficiently large for the electronuclear method, are briefly analyzed. Author (NSA)

N71-26732# European Organization for Nuclear Research, Geneva (Switzerland).

RIMING AND MEASUREMENT OF COHERENT BETATRON OSCILLATION OF A BEAM DURING THE INITIAL PHASE OF ACCELERATION [AMORCAGE ET MESURE DES OSCILLATIONS BETATRON COHERENTES DU FAISCEAU PENDANT LA PHASE INITIALE DE L'ACCELERATION]

V. N. Andrejchuk et al Nov. 1970 12 p refs Transl. into FRENCH of Gos. Kom. po Ispolz. At. Energii SSSR, Serpukhov, USSR, report IFVE-SKU-70-6 In FRENCH
(CERN-Trans-70-10; IFVE-SKU-70-6) Avail: AEC Depository Libraries

For printing the betatron oscillations, a modulator is described and shown schematically. An oscillogram of the signal obtained from the printed betatron oscillations is shown, and results of measurements of the natural behavior of the betatron oscillation frequency at the beginning of the acceleration are plotted. Also shown are curves for the frequency of the radial betatron oscillations with and without correction. NSA

N71-26733# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.

THE ENERGY DEPENDENCE OF CHARGE EXCHANGE REACTIONS FAVOURABLY USED IN LAMBSHIFT TYPE ION SOURCES

V. Bechtold, H. Brueckmann, D. Finken, L. Friedrich, K. Hamdi et al Aug. 1970 5 p refs Presented at the 3d Intern. Symp. on Polarization Phenomena in Nucl. Reactions, Madison, Wis., 1970
(KFK-1265; Conf-700811-3) Avail: AEC Depository Libraries

Iodine and argon can be favorably used in Lambshift type ion sources for selective ionization by charge exchange collisions. The energy dependence of the selectivity of these charge exchange collisions has been measured by investigating the quenching effect and the nuclear tensor polarization. Both reactions show with increasing energy the same monotonous decrease of the selectivity. For production of polarized deuterons at optimum conditions a Lamb-shift ion source is to be operated below 1 keV beam energy. Author (NSA)

N71-26734# Michigan Univ., Ann Arbor.

A MEASUREMENT OF THE 2 2S1/2-2 2P3/2 ENERGY SEPARATION (DELTA E-S), AND THE 2 2S1/2 2P1/2 ENERGY SEPARATION(S), IN HYDROGEN (n = 2): A STUDY OF A RESOLVED PERIODIC-VELOCITY PRODUCING TRANSITION BETWEEN THE HYPERFINE COMPONENTS OF THE 2 2S1/2 STATES

Toomas Rebane (Ph.D. Thesis) 1970 139 p refs
(TID-25596) Avail: NTIS

The 2S1/2 -2P3/2 energy separation (delta E-S) and 2S1/2 -2P1/2 energy separation (S) were measured in the n = 2 state of atomic hydrogen by an atomic beam radio frequency method. A beam of metastable atoms in the single hyperfine state beta sub a (F = 0, m sub f = 0) was used. The electric dipole transitions were observed at fixed frequencies by sweeping the Zeeman magnetic field parallel to the beam axis. The latter transition was observed at two widely separated magnetic fields. Measurements of the frequencies of the RF field used to drive the transitions and the magnetic fields at the line centers of the resonance curves were used together with the theory of Zeeman splitting to determine the zero field splittings (delta E-S and S). The calculation was carried out numerically by highly accurate diagonalization of the energy hamiltonian. Author (NSA)

N71-26735 Florida Univ., Gainesville.

THE SECOND MOMENT AS A TOOL FOR THE MEASUREMENT OF EXCHANGE RATES BY NUCLEAR MAGNETIC RESONANCE

Vincent Paul Heuring (Ph.D. Thesis) 1969 60 p
Avail: Univ. Microfilms Order No. 70-12241

The truncated second moments of exchange broadened NMR lines are defined by an expression S sub I, where T is the point at which the spectral intensity has fallen to T% of its maximum value and can be used to determine exchange rates. In the equal population, two-site case in the absence of spin-spin coupling and with linewidths equal to zero in the absence of exchange, the average lifetime is given. The extension of the method to cover unequal populations, finite linewidths in the absence of exchange, and spin-spin coupling of the exchanging nuclei is also discussed. Dissert. Abstr.

N71-26737# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d-Etudes Nucleaires.

EXPERIMENTAL STUDY OF THE ATTENUATION OF NEUTRONS IN VARIOUS PROTECTIVE MATERIALS USING THE NAIADE 1 DEVICE OF THE ZOE REACTOR [ETUDE EXPERIMENTALE DE L'ATTENUATION DES NEUTRONS DANS DIFFERENTS MATERIAUX DE PROTECTION A L'AIDE DU DISPOSITIF NAIADE 1 DU REACTEUR ZOE]

Michel Lott, Pierre Pepin, Lucien Bourdet, Guy Cabaret, Jacques Capsie et al Dec. 1970 100 p In FRENCH
(CEA-N-1386) Avail: AEC Depository Libraries

The principal experiments made in the Naiade I device installed in the Zoe reactor are described. The propagation of neutrons in a great number of protective materials (iron, graphite, concrete, and water) was studied. The appropriate constants, in particular for the application to the theory of one or two group diffusion, were determined. Author (NSA)

N71-26739# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

STUDY OF THE ONE PION EXCHANGE MODEL OF THE REACTION PROTON + PROTON YIELDS PROTON + NEUTRON + PION(+) IN THE I = J = 3/2 RESONANCE APPROXIMATION AT THE PROTON ENERGY OF 660 AND 970 MeV

V. C. Suslenko and V. I. Kochkin 1971 36 p refs In RUSSIAN
(JINR-P2-5572) Avail: AEC Depository Libraries

An applicability of the one-pion exchange model (OPEM) to the reaction in the initial proton energy region with its lower limit near 660 MeV, is studied by comparing the calculated differential energy spectra of pions with the experimental ones. The general expressions for the differential energy spectra of the particle and the expression in which the integration variables are explicitly shown are given. The OPEM squared matrix element reaction corresponding to the four Feynman diagrams is given. The most important consequency of the OPE model is the statement that if this model were applicable, the experimental data must be consistent with the calculates ones at different initial energies in the given region using everywhere the same form factor. As a result, one can draw the following conclusions: The OPE model is applicable at the initial proton energy region near T = 660 MeV function the result of the calculation for the integrated energy spectrum of pions for T = 660 and 970 MeV is given. Author (NSA)

N71-26741# Hahn-Meitner-Institut fur Kernforschung, Berlin (West Germany).

INVESTIGATIONS OF RADIATION RESISTANCE OF OPTOELECTRONIC DEVICES FOR AN ELECTRONICALLY SCANNING STAR SENSOR IN SATELLITES. [DIODES: 662(ENL), 602-5D, PIN 6 LC(UDT) MULTIPLIER: XP1117 (VALVO)] [UNTERSUCHUNG DER STRAHLENRESISTENZ AN LICHTEMPRAEGERN FUER VOLLELEKTRONISCHE STERNSENSOREN IN SATELLITEN]

A. Braeunig, A. Spencker, and H. G. Wagemann Jul. 1970 170 p refs In GERMAN

(HMI-B-97) Avail: AEC Depository Libraries

Several optoelectronic devices (photomultipliers and photocells) were submitted to electrical (especially noise and dark-current) and to optical (relative spectral sensitivity and photoelectric current generated by means of Johnson light) measurements before and after they had absorbed irradiations of X-rays (100 keV), electrons (600 keV), and electrons (.15 MeV). The results of the irradiations are discussed and evaluated concerning the different technology of the devices. Author (NSA)

N71-26742 Comision Nacional de Energia Atomica, Buenos Aires (Argentina).

CROSS SECTION AND YIELD RELATIONS FOR THE ISOMETRIC PAIR Y-90m/Y-90 OBTAINED BY THE (d,p) REACTION [SECCIONES EFICACES Y RELACIONES DE RENDIMIENTOS PARA EL PAR ISOMERICO Y90m/Y90 OBTENIDO POR REACCION (d,p)]

C. Corazza and S. J. Nassiff 1970 12 p refs In SPANISH

(CNEA-278) Avail: AEC Depository Libraries

The excitation functions and the cross section ratios for the isomeric pair Y-70m/Y-90 produced by the (d,p) reaction were measured up to deuteron energies of 27.0 MeV. The stacked foil method was used and no chemical separation was made of the reaction products. Author (NSA)

N71-26743# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.

THE KARLSRUHE POLARIZED ION SOURCE

V. Bechtold, H. Brueckmann, D. Finken, L. Friedrich, K. Hamdi et al Aug. 1970 9 p refs Presented at the 3d Intern. Symp. on Polarization Phenomena in Nucl. Reactions, Madison, Wis., 1970

(KFK-1262; CONF-700811-13) Avail: AEC Depository Libraries

The investigation of different charge exchange reactions shows that positively charged polarized hydrogen ion beams can be produced with a Lamb shift type ion source. The special features of the Karlsruhe polarized Lamb shift type ion source C-LASKA which is designed for operation at the Karlsruhe isochronous cyclotron are discussed. Beams of negativaly charged polarized deuterium ions have been obtained with high beam qualities and the source C-LASKA will deliver polarized deuteron beams for injection into the cyclotron with an intensity of the order of 1 micro A at an emittance of 1 cm Rad square root of (eV). Author

N71-26744# Institute of Nuclear Research, Warsaw (Poland).

Be-9(DEUTERON,ALPHA-0)Li-7(gs) AND Be-9(DEUTERON, ALPHA-1)Li-7(470 keV) REACTIONS IN THE 0.9-2.2 MeV ENERGY RANGE

A. Saganek, I. Sledzinska, A. Turos, Z. Wilhelmi, and B. Zwieglinski 1970 29 p refs

(INR-1200) Avail: AEC Depository Libraries

Angular distributions and total cross sections of Be-9(deuteron,alpha-0)Li-7(gs) and Be-9(deuteron,alpha-1)Li-7(470 keV) reactions were measured over the angular range from 15 to 165 deg (LAB) in 100-keV steps. Detailed description of the experimental technique is given. Author (NSA)

N71-26745# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimental'noi Fiziki.

STUDY OF THE REACTION PION(−) PROTON YIELDS RHO-MESON(0) PION(−) PROTON WITH MOMENTUM 4.45 GeV/c

G. V. Beketov, S. M. Zombkovskii, A. B. Kaidalov, B. S. Konovalov, S. P. Kruchinin et al 1970 16 p refs In RUSSIAN; ENGLISH summary

(ITEF-775) Avail: AEC Depository Libraries

The reaction pion(−) proton yields rho-meson (0) pion(−) proton was studied in the liquid-hydrogen bubble chamber at 4.45 GeV/c. The obtained data are in good agreement with the Regge pion-pole exchange model. Author (NSA)

N71-26748# Lyon Univ. (France). Inst. de Physique Nucleaire.

DETERMINATION OF THE INTERNAL AND SUPERFICIAL OXYGEN CONTENT OF MOLYBDENUM OBTAINED USING 54 MeV ALPHA PARTICLES AND LOW ENERGY DEUTERONS [CONTRIBUTION AU DOSAGE DE L-OXYGENE INTERNE ET SUPERFICIEL DANS LE MOLYBDENE, AU MOYEN DE PARTICULES ALPHA DE 54 MeV ET DE DEUTONS DE BASSE ENERGIE]

Lyliane Mazagol, Jean Tousset, and Michele Boissier 28 Oct. 1970 14 p refs In FRENCH

(LYCEN-7076) Avail: AEC Depository Libraries

The internal oxygen content of molybdenum samples was determined by activation with 55-MeV alpha particles. This method yielded a mean value for the oxygen content of a volume of target with a variable depth between 20 and 360 microns. The oxygen distribution profile in the immediate vicinity of the surface was studied using nuclear reactions. The oxygen content beneath the oxide layer up to a depth of about 4 microns was determined from the shape, at low energy, of the proton peak in the O-16(d,p sub 1) reaction. Rapid coincidence measurements yielded the alpha spectra in the (d,alpha) reaction. NSA

N71-26747*# Pittsburgh Univ., Pa. Dept. of Physics.

EXCITATION OF THE OI(3S) AND NI(4P) RESONANCE STATES BY ELECTRON IMPACT ON O AND N

E. J. Stone and E. C. Zipf Jan. 1971 14 p refs Submitted for publication

(Grant NGL-39-011-030)

(NASA-CR-118672; SRCC-151) Avail: NTIS CSCL 20H

The absolute cross sections for the excitation of the OI(3S) and NI(4P) resonance states by electron impact on atomic oxygen and nitrogen were measured over the aeronomically important energy range from threshold to 150 eV. The peak excitation cross sections for these states were found to be 1.2 × 10 to the minus 18th power sq cm and 6.2 × 10 to the minus 18th power sq cm respectively. At low energies the total OI(3S) and NI(4P) cross sections exhibited well-developed peaks near 15 eV and 25 eV respectively indicating that cascade processes play an important role in exciting the OI(3S) and NI(4P) states. Author

N71-26748# Atomic Energy Commission, Baghdad (Iraq). Nuclear Research Inst.

VERSATILE AND MODULAR DATA ACQUISITION SYSTEM USEFUL IN NUCLEAR EXPERIMENTS

N. H. Al-Qureishi, B. Al-Kaysi, O. A. Ohannesian, and I. S. Younan Sep. 1970 10 p

(PH-1) Avail: AEC Depository Libraries

A versatile and modular acquisition system useful in recording data from nuclear experiments is described. The overall system allows complete intercompatibility between its various subsystem modules. The functional specifications of the system are outlined. The operational characteristics of some selected circuits are reported. Author (NSA)

N71-26749# Jagellonian Univ., Cracow (Poland). Dept. of Theoretical Physics.

PREDICTIONS FOR THE DECAY DISTRIBUTIONS OF

RESONANCES PRODUCED IN THE REACTIONS 0(−) 1/2(+) YIELDS 0(+) 3/2(+), 0(−) 1/2(+) YIELDS 1(+) 3/2(+), AND 0(−) 1/2(+) YIELDS 2(+) 3/2(+)

B. Muryn May 1970 11 p refs

(TPJU-15/70) Avail: AEC Depository Libraries

Using the additive quark model, the relations between statistical tensors for single and joint decay angular distributions in reactions 0(−) 1/2(+) yields 0(+) 3/2(+), 0(−) 1/2(+) yields 1(+) 3/2(+), and 0(−) 1/2(+) yields 2(+) 3/2(+) are derived. Author (NSA)

N71-26750# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimental'noi Fiziki.

STUDY OF THE PION(−) PION(−) INTERACTION IN THE REACTION PION(−) PROTON YIELDS N(+ 2) (1238) PION(−) PION(−) WITH MOMENTUM 4.47 GeV/c

G. V. Beketov, S. M. Zombkovskii, A. B. Kaidalov, B. S. Konovalov, S. P. Kruchinin et al 1970 28 p refs In RUSSIAN; ENGLISH summary

(ITEF-767) Avail: AEC Depository Libraries

The reaction negative pion proton yields N(++)(1238) negative pion negative pion at incident momentum of 4.75 GeV/c was studied using the 50-cm hydrogen bubble chamber. This reaction was analyzed in terms of the pion-pole exchange Regge model and three versions of the OPE model. The negative pion negative pion scattering cross sections were obtained for mass ranges of the negative pion negative pion system from 0.28 GeV to 1.4 GeV. The angular distributions of negative pion negative pion and positive pion proton virtual scattering are presented. The angular distributions seem to show the considerable dependence from the background reaction negative pion proton yields negative pion proton neutral rho meson. Author (NSA)

N71-26751# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

MEASUREMENT OF HALF LIVES OF THE EXCITED STATES WITH THE ENERGY OF 155.8 AND 227 keV IN THE Tb 155 NUCLEUS

Ya. Vavryschuk, V. A. Morozov, T. M. Muminov, V. I. Razov, and Ya. Sachinskii 1970 47 p refs In RUSSIAN

(JINR-P6-5484) Avail: AEC Depository Libraries

The half-lives of 155.8 and 227 keV excited levels of the Tb-155 nucleus were measured by the electron-gamma delayed coincidence method. Intrinsic quadrupole moment and the deformed parameter of the ground state of the TB-155 nucleus were calculated. The hindrance factor is determined for the single-particle model, for the Nilsson model and for the Nilsson model with the superfluid correction for the transitions discharging the 227 keV state. Author (NSA)

N71-26752# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

SEARCH FOR AN Np 238 FISSION ISOMER [RECHERCHE D'UN ISOMERE DE FISSION DE NP 238]

Daniel Paya, Anastasios Katsanos, Jean-Luc Leroy, Andre Michaudon, and Yves Pranal Nov. 1970 9 p refs In FRENCH

(CEA-N-1339) Avail: AEC Depository Libraries

An attempt was made to investigate the possibility of forming a Np-238 fission isomer by bombarding a Np-237 target with 500-keV neutrons. The results indicated the existence of an isomer with a half-life of 12 ns. Author (NSA)

N71-26753# Atomic Energy Commission, Baghdad (Iraq). Nuclear Research Inst.

MEASUREMENT OF THE REACTION Cl-35(n,GAMMA)Cl-36 USING A THREE-CRYSTAL PAIR AND ANTI-COMPTON SPECTROMETER

J. D. Jafar, A. A. Abdulla, N. H. Al-Quraishi, M. S. Alwash, J. Kajfosz et al Sep. 1970 21 p refs

(PH-2) Avail: AEC Depository Libraries

The Cl(n,gamma) reaction was investigated, and the energies and intensities of 190 resolved gamma rays are reported. A three-crystal NaI−Ge pair and anti-Compton spectrometer was used. A computer program useful in the automatic analysis of gamma-ray spectra is briefly described. A boot-strap technique generated a self-consistent energy calibration, and the binding energy of Cl-36 was determined to be 8580.7 + or − 1 keV. Author (NSA)

N71-26758# Commissariat a l'Energie Atomique, Saclay (France). Centre d-Etudes Nucleaires.

EFFECT OF SPIN ORBIT TERMS OF THE OPTICAL POTENTIALS ON THE ASYMMETRY IN (p,d) EXPERIMENTS WITH POLARIZED PROTONS

H. Kamitsubo and B. Mayer 1970 2 p refs Presented at 3d Intern. Symp. on Polarization Phenomena in Nucl. Reactions, Madison, Wis., 31 Aug.−4 Sep. 1970

(CEA-CONF-1852; Conf-700811-12) Avail: AEC Depository Libraries

The effect of the spin−orbit terms in both proton and deuteron channels was studied in conjunction with the experimental results obtained for Sn-118(p,d)Sn-117 and Sn-119(p,d)Sn-118 reaction was shown to be very similar to that of protons elastically scattered by Sn-119. Distorted wave Born approximation (D.W.B.A) calculations were in agreement with the (p,d) asymmetry when a spin−orbit term was included only in the proton channel (PSO). The asymmetry given by a spin−orbit term in only the deuteron channel (DSO) was nearly in phase opposition with the PSO asymmetry, and the asymmetry calculated with spin-orbit terms in both channels was roughly equal to the sum of the asymmetries for PSO and DSO. D.W.B.A. calculations showed that the correlation between proton elastic scattering and (p,d) reaction disappeared at a lower energy. Opposite behavior in the asymmetry for PSO and DSO was seen in the partial-wave scattering amplitude, the spin−orbit force being more effective for lower partial waves. NSA

N71-26757# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

INTERACTION CROSS SECTIONS OF FAST PARTICLES WITH TRITIUM AND HE 2 NUCLEI

V. S. Barashenkov, S. M. Eliseev, and A. A. Ostapenko 1970 9 p refs In RUSSIAN

(JINR-P2-5335) Avail: AEC Depository Libraries

In the framework of the Glauber theory, energy dependence is calculated for the cross sections of interaction of pions and nucleons with H-3 and He-3 nuclei. Author (NSA)

N71-26758# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

OBSERVATION OF PION(−) PROTON YIELDS POSITRON ELECTRON NEUTRON REACTION AT 275 MeV

Yu. K. Akimov, L. S.Vertogradov, A. V. Demyanov et al 1970 24 p refs In RUSSIAN

(JINR-P1-5398) Avail: AEC Depository Libraries

A system consisting of scintillation and Cerenkov counters, Cerenkov total absorption spectrometers, and spark chambers was used for the pion(−) + proton yields positron electron neutron reaction detection. Electrons and positrons were registered at an angle close to 90 deg relative to the pion(−)-meson beam. The energy and the angle of emission of electrons and positrons were measured. The analysis of the data obtained identified 55 events of the reaction with the (positron, electron) pair effective mass about 300 MeV and determined the differential cross section of the reaction at an electron energy of more than 40 MeV. Author (NSA)

N71-26759# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.

ON THE EXPERIMENTAL POSSIBILITY OF REVEALING

THE REACTION I(+) + I(−) YIELDS NEUTRINO + ANTINEUTRINO + GAMMA

F. F. Tikhonin 1969 11 p refs In RUSSIAN
(NP-18558) Avail: AEC Depository Libraries

Consideration of possible ways for detecting gamma-quanta, generated in the reaction I(+) + I(−) yields neutrino + antineutrino + photon is presented. Two possibilities, suitable for registration of this process were chosen from many others (such as angular, energy distribution, polarization, etc.). These are: measuring photon-circular polarization and observation of showers, generated by gamma-quanta of large energies, when showers from charged particles and other protons are absent. Author (NSA)

N71-26760# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

REPRESENTATION FOR THE RELATIVISTIC SCATTERING AMPLITUDE AT HIGH ENERGIES

V. R. Garsevanishvili, V. G. Kadyshevsky, R. M. Mir-Kasimov, and N. B. Skachkov 1970 36 p refs Submitted for publication
(JINR-E2-5341) Avail: AEC Depository Libraries

In the framework of the quasipotential approach, high energy representation for the relativistic scattering amplitude is obtained. A basic point is an application of the Fourier analysis in terms of the nonabelian group of translations embedded as a subgroup in the Lorentz group. The representation obtained corresponds to the eikonal one in quantum mechanics. Author (NSA)

N71-26761# Institute of Nuclear Physics, Karkow (Poland).

PION PRODUCTION MECHANISM IN HIGH MULTIPLICITY PION(+) PROTON INTERACTIONS AT 8 GeV/c

T. Coghen, O. Czyzewski, A. Eskreys, J. Loskiewicz, P. Malecki et al. 1970 23 p refs Presented at the 15th Intern. Conf. on High Energy Phys., Kieve, 26 Aug.–4 Sep. 1970
(INP-708; CONF-700806-55) Avail: AEC Depository Libraries

The mechanism of pion production in eight-prong positive pion proton reactions is discussed in terms of two models: the fireball model and multipheripheral CLA model. Both models give adequate description of the general features of the experimental data, however, they fall in the prediction of fine details of the process. Author (NSA)

N71-26762# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.

NEUTRAL DECAY MODES OF THE NEUTRAL ETA-MESON PARTICLE

Z. S. Strugalski, I. V. Chuvilo, T. Gemesy, I. A. Ivanovskaya, Z. Jablonski et al 1970 19 p refs Submitted for publication
(JINR-E1-5256) Avail: AEC Depository Libraries

Results of investigation of the eta(0) meson decay modes: eta(0) meson yields 2gamma, eta(0) meson yields pion(0)gamma gamma, and eta (0) meson yields 3 pions(0) are presented. The branching ratios of neutral decay modes were evaluated. Author (NSA)

N71-26763# Central Research Inst. for Physics, Budapest (Hungary).

PULSED REACTOR POTENTIALITIES FOR NEUTRON ACTIVATION ANALYSIS

A. Cheke, A. Nad, and E. Sabo [1970] 30 p refs In RUSSIAN
(KFKI-70-25-NAC) Avail: AEC Depository Libraries

A brief review is given of characteristics of analytical methods using neutrons at various energies. Data are given of different areas in which pulsed reactors may prove to be more efficient than any other type. Studies were made of the feasibility of specimen irradiation in pulsed reactors and various suggestions are presented on the development of high-speed specimen conveyers. Descriptions are given of the design, specifications, and construction of specimen conveyers operating with 8 or 10 muon sec speed. A general description is given of possible measuring devices. NSA

N71-26764# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.

PROBLEM OF THE NEAR THRESHOLD ANOMALY IN INTERACTION OF PROTONS WITH Be 9 NUCLEI AT 2.06 MeV

P. M. Gopych, V. I. Salatskii, and I. V. Sizov 1971 6 p refs In RUSSIAN
(JINR-P15-5519) Avail: AEC Depository Libraries

The elastic scattering of protons on the Be-9 nuclei is measured for angles of 120 deg and 135 deg of lab. sys. in the energy range 1.97 to 2.18 MeV. No anomalies denoting the existence of narrow resonances in the range of the threshold (2.06 MeV) of the reaction (Be-9)(proton, neutron)B-9 are observed. Author (NSA)

N71-26765# Jagellonian Univ., Karkow (Poland). Dept of Theoretical Physics.

ON THE DETERMINATION OF THE X(960) MESON SPIN-PARITY IN THE POLARIZATION EXPERIMENT

J. Klosinski, J. Rembielinski, and W. Tybor May 1970 5 p refs
(JPJU-14/70) Avail: AEC Depository Libraries

To establish the neutral X(960) meson spin-parity it is suggested to study the forward production of the X(0) in the reaction kaon(−) proton yields X(0)Lambda hyperon on the polarized target. NSA

N71-26768# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

ON CHIRAL SU(2) x SU(2) DYNAMICS FOR A1-MESON, RHO-MESON, AND PION

V. I. Ogievetsky and B. M. Zupnik 1970 19 p refs
(JINR-E2-5249) Avail: AEC Depository Libraries

It is remarked that the conventional effective Lagrangian with Rho mesons and A1 mesons contains 3- and 4-linear derivative couplings. So one should add independently all terms with 3 and 4 derivatives, then the theory should contain a number of arbitrary parameters. A new Lagrangian is suggested for the A1 rho meson system containing no more than two field derivatives in each term. This model is determined only by four parameters g sub rho meson, g sub a, m sub rho meson, M sub a and gives the smoothest momentum dependence for the contact vertices. The reasonable value delta = −1 is derived for the anomalous magnetic moment of A sub 1 if the KSFR relation holds, and also the model is applied to pion-pion scattering and A sub 1 decay. Author (NSA)

N71-26771# Lyon Univ. (France). Inst. de Physique Nucleaire.

THE INTERDIGITAL H-TYPE (IH) STRUCTURE, AN ACCELERATING STRUCTURE FOR LOW ENERGY BEAMS

M. Bres, A. Chabert, F. Foret, D. T. Tran, and G. Voisin Jul. 1970 35 p refs
(LYCEN-7055) Avail: AEC Depository Libraries

A brief description of the structure is given; its principal characteristics, which have been deduced from a series of experiments, are discussed from a theoretical point of view. Its practical use in an accelerator is considered and the Lyon heavy ion linear accelerator project is used as an illustration. Author (NSA)

N71-26778# Jyvaskyla Univ. (Finland). Dept. of Physics.

TABLE OF CROSS SECTIONS OF SOME REACTIONS INDUCED BY 14-15 MeV NEUTRONS

H. Leppaemaeki and J. Kantele Jul. 1970 50 p refs
(NP-18616; Rept-3/1970) Avail: AEC Depository Libraries

Values of cross sections of reactions measured for neutrons having a mean energy in the range of 14 to 15 MeV are listed in two tables: cross sections of some reactions, and cross sections (in millibarns) of the reaction (n,n prime) and of some rare reactions induced by 14- to 15-MeV neutrons. NSA

N71-26782# Central Research Inst. for Physics, Budapest (Hungary).
SUPERSELECTION RULES AND INTERNAL SYMMETRIES
A. Frenkel 1970 9 p refs
(KFKI-70-22-HEP) Avail: AEC Depository Libraries

Superselection rules and internal symmetries are discussed, including superselection rules for angular momentum and fermion number, the relativization of superselection rules, and the relation of superselection rules and internal symmetries. NSA

N71-26783# Jagellonian Univ., Carcow (Poland). Dept. of Theoretical Physics.
REGGE POLE MODEL WITH VENEZIANO RESIDUES FOR REACTIONS 0(-) 1/2(+) YIELDS 0(-) 3/2(+)
P. Gizbert-Studnicki, A. Golemo, and K. Zalewski Feb. 1970 21 p refs
(TPJU-3/70) Avail: AEC Depository Libraries

A Regge pole model for the reactions pion nucleon yields pion Delta hyperon, pion nucleon yields eta-meson Delta hyperon, and kaon nucleon yields kaon Delta hyperon is proposed. The description of the decay distributions and differential cross sections is good. The model contains six free parameters: the intercepts of the rho meson and A2 trajectories, a universal slope, the eta meson, eta' meson mixing angle, and two coupling constants. The number of free parameters is kept low by the use of the quark model and of the Venesiano formula for the residues. The predictions for the differential cross-sections of the pion(+) proton processes at 16 GeV/c are also given. Author (NSA)

N71-26784# Atomic Energy Commission, Baghdad (Iraq). Nuclear Research Inst.
DETERMINATION OF URANIUM CONTENT IN GEOLOGICAL SAMPLES BY NEUTRON ACTIVATION
M. R. Ahmed, A. A. Abdulla, and G. Y. Al-Shahiry Sep. 1970 10 p refs
(PH-3) Avail: AEC Depository Libraries

Samples were irradiated in the IRT 2000 research reactor. The decay rate of Np-239 yields Pu-239 was measured and compared with a standard of known uranium content. Two techniques were applied; in the first method a Ge(Li) gamma spectrometer of high resolution was used to measure the gamma ray spectrum from this decay. In the second, scintillation counters were placed in coincidence for detecting two-step cascade gamma ray from the same decay. The results from both techniques were in satisfactory agreement. Author (NSA)

N71-26785# Nuklearni Institut Jozef Stefan, Ljubljana (Yugoslavia).
SPIN-LATTICE RELAXATION BY QUASI-SPIN WAVES IN ORDER-DISORDER TYPE FERROELECTRICS: POLARIZATION FLUCTUATIONS IN $Ca_2Sr(C_2H_5)_2(CH_3COO)_6$
R. Blinc, S. Zumer, and G. Lahajnar Jan. 1970 17 p refs
(IJS-575) Avail: NTIS

A theory of nuclear spin-lattice relaxation by unstable overdamped quasi-spin wave or critical polarization fluctuations in the order-disorder ferroelectrics is developed. If relaxation due to competing processes is not too fast such an unstable mode dominates the magnetic dipolar or electric quadrupolar relaxation rate not only right at the Curie point, but also in its neighbourhood. The theory is applied to the case of ferroelectric dicalcium strontium propionage. The crystal exhibits an anomalous dip in T sub 1 on approaching T sub c which believed to be due to magnetic dipolar coupling to an overdamped unstable qusi-spin wave mode. Author

N71-26791# Commissariat a l'Energie Atomique, Saclay (France.)
BEAM REGULATION IN A 100 MeV PROTON LINEAR ACCELERATOR [REGLAGE DU FAISCEAU DANS L'ACCELERATEUR LINEAIRE A PROTONS DE 100 MeV]
V. A. Batalin et al [1970] 17 p refs Transl. into FRENCH of Gos. Kom. po Ispol. At. Energii SSSR, Serpukhov, USSR, report IFVE-69-9 In FRENCH
(NP-tr-1926; IFVE-69-9) Avail: AEC Depository Libraries

Beam regulation in a 100-MeV accelerator is discussed, including a description of the accelerator components, method of beam regulation, the gradual adjustment of the acceleration region in the various parts of the accelerator, and the physical starting of the accelerator. The alignment of the preinjector accelerator tube, betatron oscillations, the maximal dimensions and divergence angles of the beam in the median planes, and the variation of the current as a function of the field gage are considered. NSA

N71-26792# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
CROSS SECTION OF THE ELECTRON-POSITRON PAIR PRODUCTION BY GAMMA-QUANTA WITH THE ENERGY FROM 35 TO 2000 MeV IN LIQUID XENON
M. Dworakowski, B. Slowinski, Z. Strugalski, and B. Janowska 1970 8 p refs In RUSSIAN
(JINR-P1-5482) Avail: AEC Depository Libraries

Cross sections of the electron-positron pairs produced by gamma-quanta with the energy from 35 to 2000 MeV in liquid xenon were determined experimentally. The analysis of the results is given. Author (NSA)

N71-26793# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
LIFETIME OF EXCITED STATES IN SPHERICAL NUCLEI La 139, La 135, AND La 133
R. Babadzhanov, V. A. Morozov, T. M. Muminov, V. I. Razov, and A. B. Khalikulov 1970 16 p refs In RUSSIAN
(JINR-P6-5200) Avail: Issuing Activity

Determination of the probability of forbidden transitions is an effective method for the study of the structure of spherical nuclei; therefore, the lifetimes of the lower excited state were measured in the spherical nuclei La-133, La-135, and La-139. The lifetimes of the 119.4-keV level of La-135 and the 97- and 130.7-keV levels of La-133 were determined by means of an e-gamma coincidecne instrument; the 165.8-keV level of the La-139 nucleus was measured by gamma-gamma coincidence. The decay of the radioactive cerium isotopes served as basis of the study. The results indicated that the above transitions are forbidden by the orbital quantum number. The quantum characteristics of the ground and lower excited levels of La-139 and La-135 nuclei were confirmed in the same experiments. The transition may be considered as one-particle one only in the first approximation. NSA

N71-26794# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
ANGULAR DISTRIBUTION OF THE NEUTRON-PROTON FINAL STATE INTERACTION IN THE REACTION d + p YIELDS p + p + n [WINKELVERTEILUNG DER NEUTRON-PROTON-FINAL-STATE-INTERACTION IN DER REAKTION d + p GIBT p + p + n]
K. Wick (Ph.D. Thesis - Karlsruhe Univ.) Jul. 1970 101 p refs In GERMAN
(NP-18561) Avail: AEC Depository Libraries

The three-nucleon reaction was investigated in kinematic complete experiments with deuterons at 52 MeV energy. The np final state interaction forms at small relative energies of neutron and proton the dominating reaction mechanism. Both protons were detected under such angles in coincidence that np pairs with the relative energy = 0 could be observed. The analysis of the measurements with help of the Watson-developed model of the final state interaction permits a distribution of the measured coincidence spectra into the reaction fractions which operate on the singlet and triplet states of the np subsystem. The analysis of the final state

interaction yields a value for the np singlet state scattering length. The comparison with the scattering length known from free np scattering shows that nucleon–nucleon scattering data can also be obtained from three-particle reactions with good accuracy. The systematic investigation under very different angle pairs leads simultaneously to the result that an accurate determination of the scattering length in the reaction is possible only under very favorable kinematic conditions. Author (NSA)

N71-26795# Jagellonian Univ., Cracow (Poland). Dept. of Theoretical Physics.

POLARIZATION OF LAMBDA AND SIGMA HYPERONS IN TWO-BODY Y-RESONANCE PRODUCTION PROCESSES AND THE QUARK MODEL

Andrzej Bialas and Andrzej Kotanski Feb. 1970 12 p refs

(TPJU-2/70) Avail: AEC Depository Libraries

The two-body Y^* production processes with $0(-)\ 3/2(+)$, $1(-)\ 3/2(+)$ and $3/2(+)\ 3/2(+)$ final states are considered. The measurements of the polarization of Lambda and Sigma hyperons are discussed in the framework of the additive quark model. Several constraints are derived. The results provide strong and qualitatively new tests of the additivity assumption. In addition, a short summary of the experimental methods of determining the polarization moments of hyperons is given. Author (NSA)

N71-26798# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

REGGE MODELS INCLUDING 4 POLES rho-MESON, rho-MESON', A2 AND A2' IN THE PION NUCLEON AND KAON NUCLEON CHARGE EXCHANGE REACTIONS FROM 2 TO 20 GeV/c

Jean-Pierre de Brion and Andre Derem Nov. 1970 49 p refs In FRENCH

(CEA-N-1373) Avail: AEC Depository Libraries

All the available experimental data on the reactions pion(−) proton yields pion(0) neutron, pion(−) proton yields eta-meson neutron, atikaon(−) proton yields kaon (0) neutron, and kaon (+) neutron yields kaon(0) proton are analyzed in the framework of an exchange model with four Regge poles. The model is extrapolated towards low energies and gives a good description of the differential cross sections down to about 2 GeV. The dominance of the SU(3) octet exchange, with spin and parity 1(−) and 2(+), is not satisfied below 4 GeV, owing to difficulties which arise mainly from kaon(+) nucleon scattering. NSA

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N71-25606# Avco Corp., Wilmington, Mass. Systems Div.

CONSIDERATIONS FOR NONLINEAR MICROWAVE BREAKDOWN AND PROPAGATION

Ronald L. Fante 16 Jan. 1971 32 p refs

(Contract F19628-69-C-0121)

(AD-719764; Scientific-3; AFCRL-71-0023) Avail: NTIS CSCL 20/9

Approximations have been considered which lead to a simplified model for non-linear microwave breakdown. Using the simplified model we have then analytically considered the transmission of a plane wave into a non-linear medium, in the steady state. We have also presented numerical solutions, for the non-steady state case. GRA

N71-25633# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics and Fusion Research.

ROTATING PLASMAS

B. Lehnert Nov. 1970 152 p refs

(Rept-70-37) Avail: NTIS

A review is given of theoretical and experimental investigations on rotating plasmas. The basic equations are discussed from the microscopic and macroscopic points of view, including the balance of matter, momentum, and heat, as well as associated stability problems and limiting effects. Various types of devices are described, and obtained experimental results are compared with theoretical predictions. The review also summarizes the applications of rotating plasmas to fusion research, cosmical physics, and special technical arrangements such as plasma centrifuges, adjustable plasma condensers, plasma gun, and propulsion systems. Author (ESRO)

N71-25708# Stanford Univ., Calif. Inst. for Plasma Research.

COLLISIONAL EFFECTS ON WAVES IN A MAGNETOPLASMA Interim Report, 22 Nov. 1968–31 May 1970

John Quayle Howell Wright-Patterson AFB, Ohio ARL Nov. 1970 167 p refs

(Contracts F33615-67-C-1284; AF 33(615)-1504)

(AD-719798; SU-IPR-364; ARL-70-0263) Avail: NTIS CSCL 20/9

A new class of collision-dependent electron waves is found in a non-Maxwellian Lorentz magnetoplasma, and it is shown that these waves may be driven unstable by electron-neutral collisions. The Boltzmann equation with collision integral is solved, assuming propagation either parallel or perpendicular to the magnetic field. Both conductivity tensors are derived and put in a form useful for numerical calculations. The full set of Maxwells equations is then used to derive the dispersion relations for both directions of propagation. The dispersion relations are initially solved for a monoenergetic electron distribution function and following that a distribution with a peak of nonzero halfwidth is treated. Some consideration is also given to a Maxwellian distribution both with and without a bump on the tail. As an example of propagation parallel to the magnetic field, transverse electromagnetic or whistler waves are considered. Author (GRA)

N71-25709# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

PLASMA ACCELERATION IN A TRAVELING ELECTROMAGNETIC FIELD. GENERAL DIAGNOSTIC AND VELOCITY MEASUREMENT [ACCELERATION D'UN PLASMA PAR UN CHAMP ELECTROMAGNETIQUE GLISSANT. DIAGNOSTICS GENERAUX ET MESURES DE VITESSE]

Marc Charpenel, Jean-Pierre Rager, and Bernard Sitt 1971 31 p refs In FRENCH; ENGLISH summary

(ONERA-NT-174) Avail: NTIS

An experimental set-up has been designed in view of studying the processes of ionization and acceleration of a plasma in a traveling electromagnetic field, and of exploring its fundamental characteristics (temperature, density, velocity). This apparatus works in a pulsed regime, so that simple diagnostic methods can be used for measuring the electric and magnetic fields, the induced current density, the temperature, and the velocity. An indirect technique is also used for determining the last two parameters. The overall results are analyzed and discussed. They apparently show that there exists, near the exhaust section, a temperature wave traveling at the same velocity as that of the relative electric field. Author (ESRO)

N71-25710# Hebrew Univ., Jerusalem (Israel). Dept. of Physics.

PLASMA PROPAGATION INTO LOW-PRESSURE GAS AND PLASMA IN A MAGNETIC FIELD Final Scientific Report, 1 Oct. 1965–30 Sep. 1968

A. S. Kaufman 31 Aug. 1970 12 p refs

(Contract AF 61(052)-891)

(AD-719885; AFCRL-70-0604) Avail: NTIS CSCL 20/9

The propagation of plasma into an ambient gas at low pressure in the presence of an external electric field was investigated experimentally and theoretically. The important feature is the slow speed of plasma expansion which is of interest in the problem of plasma containment. A possible connection with space physics was sought but not found. The positive column of an arc discharge with and without an external magnetic field was investigated spectroscopically using the singlet-triplet ratio method in helium. Analysis of results showed that the electron-velocity distribution function was not Maxwellian near the wall of the discharge tube. Transfer of the uniform column to the helical form at the critical value of the magnetic field was demonstrated without perturbing the plasma in any way. Author (GRA)

N71-25711# New York Univ., N.Y. Dept. of Electrical Engineering.

BOUNDARY PROBLEMS AT A PLANE INTERFACE BETWEEN VACUUM AND VLASOV PLASMA

Kyohei Sakuda Jan. 1971 72 p refs

(Contracts N00014-67-A-0467-0018; Nonr-285(66))

(AD-719926; TR-402-5) Avail: NTIS CSCL 20/9

In the report, the boundary problem at the interface between vacuum and plasma is studied. The plasma is one component and homogeneous, but, anisotropic due to an external static magnetic field. The plasma is described by the linearized Vlasov equation. According to the authors best knowledge this is the first time that a kinetically described anisotropic boundary value problem is treated. In order to obtain the field quantities, i.e., first order electric and magnetic field, and the velocity distribution function, the dyadic Greens function is obtained, then by applying the completeness relationship, the complete set of eigenvectors are derived. Using superposition, all first order quantities are obtained in terms of the complete set of eigenvectors once the expansion coefficients are determined. The expansion coefficients are determined by the speculum assumption, the causality condition, and outgoing wave condition. Author (GRA)

N71-25768# California Univ., Livermore. Lawrence Radiation Lab.

CHARGE EXCHANGE EXPERIMENT WITH A FAST PLASMA BUNCH IN THE INES INSTALLATION

L. V. Zamarashkin et al Oct. 1970 66 p refs Transl. into ENGLISH of Akad. Nauk SSSR, Inst. At. Energii, Moscow, report IAE-1951

(UCRL-Trans-10497; IAE-1951) Avail: NTIS

The possibility of obtaining a dense beam of hydrogen atoms with particle energies above 1 keV by means of charge exchange in a magnesium vapor target from plasma clusters generated by a coaxial plasma gun is investigated. It is shown that the charge exchange takes place in agreement with a pair collisions model for incident beam densities on the order of 10 to the 12th power minus cu cm and the target efficiently removes particles with energies lower than 1 keV from the beam. Author (NSA)

N71-25769# Los Alamos Scientific Lab., N.Mex.

A NEW SCHEME FOR A DOUBLE TURN STELLARATOR

I. S. Danilkin et al Jun. 1970 24 p refs Transl. into ENGLISH of Akad. Nauk SSSR, Inst. Fiz., Moscow, report NP-18378

(LA-tr-70-22; NP-18378) Avail: NTIS

A new design is discussed for a two-inlet stellerator capable, in principle, of satisfying new requirements for plasma containment. The new system exhibits a higher stability of magnetic field configuration, and is less influenced by the toroidality and other faults of the construction; also, it is capable of more efficient particle containment and has a latitude of theta > or = to 0.1. The construction of the system provides easy access to the operating area filled with plasma and offers good vacuum necessary for the experiments. The stellarator is very economical in using the magnetic field at low mechanical loads. Containment of plasma in the stellerator field under exceptionally clean conditions was achieved. NSA

N71-25906# Columbia Univ., New York. Plasma Physics Research Lab.

PRODUCTION AND INVESTIGATION OF VERY STRONG IONIZING SHOCK WAVES

Einar Halmoy Mar. 1971 132 p refs

(Contract F44620-71-C-0010)

(AD-720838; Rept-53; AFOSR-TR-71-0728) Avail: NTIS CSCL 14/2

The design and construction of a high energy shock tube is described, and experiments with transverse ionizing shock waves are reported. Shock speeds up to one percent of the speed of light are measured, and separation of shock and driver current is observed. Compressions of mass and magnetic field are measured and shown to agree with the predictions of the theory of ionizing shocks. The electron temperature in the post-shock plasma is found to be about 1 keV. Neutron emission was detected from shocks in dueterium. The polarity of the axial electric field is opposite to the direction of shock propagation. It is shown theoretically that this will cause an outward radial plasma drift. The measured electric field has a significant effect on the electron-ion energy relations. The suggested conduction mechanism is a combination of Hall effect and ion displacement current. Author (GRA)

N71-25907# Columbia Univ., New York. Plasma Physics Research Lab.

THERMONUCLEAR REACTION WAVES AT HIGH DENSITIES

Ming-Sheng Chu Mar. 1971 147 p refs

(Contract F44620-71-C-0010)

(AD-720839; Rept-54; AFOSR-TR-71-0729) Avail: NTIS CSCL 20/9

Phenomena are studied of the ignition and the development of plane thermonuclear reaction waves propagating through solid density deuterium-tritium plasmas. The motivation of this study is to explore and understand laser heating of solid D-T targets for possible controlled thermonuclear fusion applications. The state of the plasma can be described by a two temperature gas and in general, it is optically thin to its own radiation. The equations governing the change of density, velocity, electron temperature, ion temperature and degree of reaction are derived from the conservation laws and the laws of reaction kinetics. The physics is contained within a set of five coupled nonlinear partial differential equations. Terms in the equations take explicit account of thermonuclear reactions and heating, conduction, electron-ion equilibration, bremsstrahlung cooling and other fluid dynamic effects. Qualitative behavior of the physical variables is discussed. Solutions of the equations are obtained by employing finite difference techniques. Author (GRA)

N71-25916# Aerospace Research Labs., Wright-Patterson Ohio. Plasma Physics Research Lab.

CLASSICAL PATH CALCULATIONS OF THE IMPACT BROADENING OPERATOR FOR THE STARK BROADENING OF H sub alpha Final Report

M. E. Bacon Dec. 1970 77 p refs

(AD-720817; ARL-70-0276) Avail: NTIS CSCL 20/9

Previous classical path calculations of the impact-broadening operator (phi) for the Stark broadening of the hydrogen line H sub alpha are reviewed. Phi is then computed by solving numerically for the S-matrices using the straight-line-classical path approximation. All contributing mutipoles in the perturber-atom interaction V(t) are included and time ordering of the operators in the S-matrices is retained. The resulting phi matrix elements are compared with the previous approximations. The effects on the H sub alpha line profile are considered. Author (GRA)

N71-26074# Joint Inst. for Nuclear Research, Dubna (USSR).
DEBYE APPROXIMATION APPLIED TO THE AVALANCHE TO STREAM TRANSITION
A. T. Matyushin and V. T. Matyushin 1970 18 p refs In RUSSIAN
(JINR-P13-5504) Avail: AEC Depository Libraries

The development of the avalanche and streamer in gases in a homogeneous electric field is studied, taking account the Debye screening radius. Based on the Langmuir plasma determination, a criterion for the avalanche-to-streamer transition is obtained, after some simplifications, which is proven by available experimental data. With the aid of this criterion an empirical constant of streamer theory is explained, and the behavior of this constant when changing E/p is predicted. The criterion does not contradict the Loeb, Meek and Raether conditions. Some ratios applied to the streamer chambers are given. Author (NSA)

N71-26075*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CALCULATION OF ELECTRON CONCENTRATION FOR A BLUNT BODY AT ORBITAL SPEEDS AND COMPARISON WITH EXPERIMENTAL DATA
Charles J. Schexnayder, Jr., Paul W. Huber, and John S. Evans Washington May 1971 85 p refs
(NASA-TN-D-6294; L-6705) Avail: NTIS CSCL 20I

Calculation of electron concentration for a blunt-nosed body at orbital speeds has been made by use of pure-air nonequilibrium chemistry throughout the flow field and for the same flow field with alkali contamination (in local ionic equilibrium) in the boundary layer. Plasma diagnostic data from onboard Langmuir probes, reflectometers, and antenna voltage standing wave ratio, along with passive data from attenuation of beacon and telemetry signals, are available for the first two RAM C reentries. These data are compared with calculated flow field ionization and radio frequency signal attenuation for both inviscid flow and for inviscid flow merged with boundary layer. In general, there is good agreement between plasma theory and the data. Above 71 km, ambipolar electron-ion diffusion was found to have a major influence on profile peak values of electron concentration. For RAM C-1 at altitudes less than 60 km, there is a large increase in electron concentration in the boundary layer due to ionization of alkali impurities from the heat shield. Indications of boundary layer transition along the body and of ablation rate on the nose were obtained from the low altitude reflectometer data. Author

N71-26078# Naval Research Lab., Washington, D.C.
PLASMA HEATING DUE TO THE BEAM CYCLOTRON INSTABILITY
John B. McBride, Martin Lampe, Wallace M. Manheimer, Joseph H. Orens, Ravindra N. Sudan et al Feb. 1971 20 p refs
(AD-720675; NRL-MR-2216) Avail: NTIS CSCL 20/9

The paper discusses the nonlinear evolution of a plasma which is beam cyclotron unstable with emphasis on the expected amount of plasma heating. GRA

N71-26146# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
ANTENNAS IN COMPRESSIBLE PLASMAS
James P. Rybak Dec. 1970 72 p refs
(Contract F19628-70-C-0035)
(AD-720262; SR-2; AFCRL-70-0715) Avail: NTIS CSCL 9/5

Measurements of antenna impedance are frequently used to determine the properties of plasmas which occur in the ionosphere and during the atmospheric reentry of space vehicles. An accurate understanding of the performance of antennas in plasmas is required for these purposes as well as for determining ways to minimize the reentry communications blackout problem. The results of the ionospheric rocket experiments have indicated the necessity, when analyzing antenna performance, of using a warm or compressible plasma theory which takes into account the thermal motion of the plasma particles. The classical derivation of the hydrodynamic, compressible plasma theory equations is included in this report together with a discussion of appropriate boundary conditions. A review of the antenna analyses which have been performed using this compressible plasma theory is presented to illustrate the present state of the art of antenna-plasma analysis. Author (GRA)

N71-26171# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
[RESEARCH IN PLASMA PHYSICS DURING 1969] Annual Report [INSTITUT FUER PLASMAPHYSIK JAHRESBERICHT, 1969]
[1970] 197 p refs In GERMAN
(NP-18496) Avail: AEC Depository Libraries

Brief discussions of research during this period are given for the following: (1) Isar devices, (2) plasma heating by shock waves, (3) measuring methods in hot plasmas, (4) stationary heating of dense plasmas, (5) plasma production by laser beams, (6) MHD generators, (7) surface physics, (8) relativistic plasma, (9) kinetic theory of plasma, and (10) various engineering developments. NSA

N71-26190# Avco-Everett Research Lab., Everett, Mass.
RESEARCH ON MFD ENERGY CONVERSION Final Report
James E. Klepeis and Jean F. Louis Wright-Patterson AFB, Ohio ARL Nov. 1970 97 p refs
(Contract F33615-69-C-1450)
(AD-720257; ARL-70-0244) Avail: NTIS CSCL 10/2

In noble gases, the elevation of the electron temperature by Joule heating has been clearly demonstrated, but it has also been well established that this nonequilibrium is associated with an ionization instability. The latter leads to electron density nonuniformities and results in a change of the bulk plasma properties. MHD generators driven by molecular or combustion gases and operating at high Hall coefficients are not, a priori, immune from similar instabilities occurring either locally (over the insulators) or in the bulk of the plasma. The purpose of the present study was to determine the bulk properties of the plasma at high Hall coefficients in various molecular gases. The facility used was a disk generator driven by a shock tube. Author (GRA)

N71-26283# Naval Postgraduate School, Monterey, Calif.
EHD RESEARCH Final Report, 1969 - 1970
Oscar Biblarz, K. E. Woehler, and T. H. Gawain 30 Dec. 1970 198 p refs
(AD-720694; NPS-57ZI0121A) Avail: NTIS CSCL 20/9

This is the second year-end report on the EHD contract. Whereas previous work concentrated on building up the experimental facility and on delineating the effects of turbulence on breakdown, this work details the effects of turbulence on charged particle mobility. The two-phase injector is used exclusively. Spectral measurements of velocity and collector current are reported. These are used to determine the potential use of EHD in anemometry and to deduce particle size distributions. Measurements of charge distribution are also reported and a comparison is made between these and the spectral measurements. Equations defining an axisymmetric, turbulent EHD flow have been derived. Also, the feasibility of flow separation control with an EHD interaction has been investigated. Author (GRA)

N71-26345 California Inst. of Tech., Pasadena.
MICROWAVE ABSORPTION AND EMISSION FROM MAGNETIZED AFTERGLOW PLASMAS
Reiner Ludwig Stenzel (Ph.D. Thesis) 1970 180 p
Avail: Univ. Microfilms Order No. 70-12498

The microwave scattering properties of an axially magnetized afterglow plasma column in an S band waveguide were investigated

experimentally. Strong absorption is found in the range of upper hybrid frequencies. A microwave radiometer was used to measure the noise power and with a comparison and null-technique, the electron temperature. Spatially resolved temperature data are obtained. Time resolution is obtained by gating the radiometer. The peak electron density is derived from the emission or absorption onset at the maximum upper hybrid frequency and confirmed by independent measurements. With this diagnostic technique the electron density and temperature decay was studied under a variety of experimental conditions. The diagnostic method is successfully applied in a microwave heating experiment. The existence of absorbing resonant layers is shown by a peak in the radial temperature profile where the local upper hybrid frequency equals the heating frequency. Dissert. Abstr.

N71-26426# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Plasmaphysik.
STEADY STATE GENERATION OF ROTATING MULTIPOLES FOR PLASMA EXPERIMENTS IN THE Mcs RANGE
C. Bastian Jun. 1970 61 p refs
(JUL-667-PP) Avail: AEC Depository Libraries

The cyclic delay-line connection of three interlaced multipole coils and of three capacitors has two ringing modes producing multipolar magnetic field patterns that rotate in opposite directions around the axis of permutation of the coil assembly. Sustainment of a prescribed mode is made possible by a three-phase (Mc) cw transmitter system driven through feedbacks. Rotating multipolar patterns with shear or axial gradient of the amplitude can be realized in the same way. This leads to the concept of inductive plasma turbines, with possible applications to plasma beam acceleration and direct energy conversion. Author (NSA)

N71-26448# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France).
MAGNETIC FLUX SINGULARITIES OBSERVED IN THE HARMONICA 2. MACHINE (1968 EXPERIMENTS) [SINGULARITES DE FLUX MAGETIQUES OBSERVES DANS LA MACHINE HARMONICA 2 (EXPERIENCES DE 1968)]
P. Ginot et al Nov. 1970 65 p refs In FRENCH; ENGLISH summary
(EUR-CEA-FC-463) Avail: AEC Depository Libraries

The Harmonica 2 machine was modified in order to improve the techniques for observing already-recorded singularities similar to the ones predicted by the Mercier theory on equilibrium. The new measurements confirm the earlier results and show that the mode of perturbation described by Mercier is dominant in the observed singularities. However, the identification is not yet certain. Author (NSA)

N71-26449 Brown Univ., Providence, R.I.
AN ANALYSIS AND DESIGN STUDY OF THE COMPRESSIBLE, TRAVELING WAVE, MAGNETOHYDRODYNAMIC, INDUCTION GENERATOR
Richard Carl Lessmann (Ph.D. Thesis) 1969 161 p
Avail: Univ. Microfilms Order No. 70-8751

The generator is composed of an annular flow passage arranged coaxially with a set of field coils. Interaction between the traveling-wave magnetic field and the moving fluid induces ring currents, in the flow gap, which inductively couple to the field coils. The analysis is based on a set of fundamental equations which neglect the effects of viscosity and heat conduction but admit arbitrary thermal and caloric equations of state. The results are used to investigate the procedure of end coil matching and several electrical characteristics of the generator including: impedance, generated power, and conversion efficiency. The time-averaged flow problem is solved for several different design cases and non-dimensional plots of the results are included. Based on an approximation to the stability criterion it is shown that while no region of parameter space is absolutely stable, maximum stability, for all disturbance frequencies, is obtained when the square of the ratio of the mean Alfven speed to the speed of sound is small. Dissert. Abstr.

N71-26458# Joint Publications Research Service, Washington, D.C.
WORK ON MAGNETOHYDRODYNAMICS (SYMPOSIUM IN THE USA)
V. V. Prokudin *In its* Vestn. of the USSR Acad. of Sci., Vol. 40, No. 6, 1970 31 Aug. 1970 p 127-132 refs (See N71-26452 14-30)
Avail: NTIS

Engineering aspects of magnetohydrodynamics are described in brief abstracts of a number of studies. Considered are cyclic magnetohydrodynamic generators working on combustion products, plasma diagnostics and the investigation of discharge electrodes, designs of installations and closed-cycle generators, and channel flow and phenomena of instability. G.G.

N71-26634# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
MAGNETOHYDRODYNAMICS STUDY OF EQUILIBRIA OF PLASMAS WITH REVOLUTION SYMMETRY [CONTRIBUTION A L'ETUDE MAGNETO-HYDRODYNAMIQUE DES EQUILIBRES D'UN PLASMA EN SYMETRIE DE REVOLUTION]
J. H. Misguich Jul. 1970 178 p refs
(EUR-CEA-FC-551) Avail: AEC Depository Libraries

The MHD equations are studied in the cylindrical approximation for toridal plasmas with revolution symmetry (Tokamak). The dependence of the poloidal beta on the diffusion and on the anisotropy of the electrical conductivity is examined. A simple model of the energy balance allows a rather good evaluation of the energy confinement time for T3 and TM3. The MHD equations with revolution symmetry, and including toroidal effects, are derived. The class of linear equilibria, is used to obtain the local diffusion velocity distribution in the plasma. The Shafranov result for the equilibrium position of the plasma is generalized for an external medium with a nonvanishing current density. A new class of equilibria, exponential, is than solved and applied to a simple energy balance model and to the description of the external medium surrounding the plasma in the screw-pinch. Author (NSA)

N71-26641# Boeing Scientific Research Labs., Seattle, Wash.
THE CONCEPT OF CONDUCTIVITY
J. E. Drummond, R. A. Gerwin, and B. G. Springer [1971] 36 p refs Presented at the 1969 Intern. Plasma Phys. Inst.
(AD-720722; D1-82-0021-A) Avail: NTIS CSCL 20/9

The concept of conductivity in a hot plasma is reviewed and criticized. In particular, it is shown that even for arbitrarily small field strengths, a proportionality constant (tensor) does not in general exist between a frequency component of the field strength and the corresponding component of current density. Rather, insisting upon such a proportionality for a homogeneous plasma, defines a complete set of spatial field configurations (eigenfunctions of the conductivity). Each of these eigenfunctions separately satisfies Maxwells equations. However, for an inhomogeneous plasma, even this is not possible, since, the eigenfunctions of conductivity are not solutions of Maxwells equations. Consequently, no intrinsic property of the medium can be found to relate current density to electric field strength. Author (GRA)

N71-26738# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii. Moscow (USSR). Inst. Atomnoi Energii.
PROPAGATION AND ABSORPTION OF IONIC-HYBRID WAVES IN A SLIGHTLY-HETEROGENEOUS PLASMA LAYER
V. M. Glagolev 1970 44 p refs In RUSSIAN
(IAE-1949) Avail: AEC Depository Libraries

The problem of propagation and absorption of ionic-hybrid waves in a slightly heterogeneous plasma layer is considered. The

plasma's density increases in a direction perpendicular to the magnetic field. Excitation of the electromagnetic waves is accomplished in a region having a low plasma density. It is demonstrated that for the wave penetration into a plasma, the retardation of a wave along the magnetic field is necessary. Conditions are stipulated for transforming the electromagnetic wave to a plasma wave; calculations are made of the collisionless ionic and electron absorption of a wave both in the presence and in the absence of transformation. NSA

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N71-25613# Minnesota Univ., Minneapolis. Dept. of Chemical Engineering and Materials Science.
IN-SITU ELECTRON MICROSCOPE INVESTIGATION OF THE NUCLEATION AND GROWTH OF SPUTTERED THIN FILMS Annual Technical Progress Raport
Thomas E. Hutchinson and Dudley Sherman 22 Jan. 1971 26 p refs
(Contract AT(11-1)-1790)
(COO-1790-3; ATPR-3) Avail: NTIS

Continuing research on nucleation and film growth and development of vacuum chamber equipment are reported. Nucleation and growth of silver on amorphous carbon in high vacuum was observed with an electron microscope, and significant spurious experimental results are described. Abnormal islands in polycrystalline and severely faulted single crystals were also studied with a scanning electron microscope. Modifications to the Varian ultrahigh vacuum chamber and associated equipment for installation on the electron microscope are discussed briefly, along with nucleation and growth processes and differences between sputtered and evaporated thin films. N.E.N.

N71-25614# Howard Univ., Washington, D.C. Dept. of Chemistry.
KINETIC, MAGNETIC, AND MOESSBAUER STUDIES ON PORPHYRIN SYSTEMS Progress Report, 15 Apr. 1969 - 14 Apr. 1970
Peter Hambright 12 Jan. 1971 12 p refs
(Contract AT(40-1)-4047)
(TID-25652) Avail: NTIS

The kinetics of metal ion interactions with porphyrin type molecules is described. The specific reactions mentioned include the following: acid catalyzed solvolysis of Zn(II), Zn(II) displacement from N-methyl porphyrin, N-methyl porphyrin metal catalyzed demethylation, incorporation of Zn(2+) and Cd(2+) into porphyrins and N-methyl porphyrins, and electrophilic substitution of one metal ion for another coordinated in a porphyrin. Twelve vanadyl prophyrins and ten ferric porphyrins were synthesized and characterized. N.E.N.

N71-25708# National Science Foundation, Washington, D.C.
THE ROLE OF IONIC DIFFUSION PROCESSES IN THE ENTRY OF THE CONSTITUENT MATERIALS OF A SPECIMEN INTO THE SPARK DISCHARGE ZONE [K VOPROSU ROLI DIFFUZIONNYKH PROTSESSOV V POSTUPLENII SOSTAVLYAYUSHCHIKH VESHCHESTV PROBY V ZONU ISKROVOGO RAZRYADA]
I. A. Grikit 1970 12 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskopii, Akad. Nauk Belorussk. SSR (Minsk), v. 5, no. 3, 1966 p 280-283 Prepared in part by NBS
(TT-70-57063; DMDC-4015) Avail: NTIS CSCL 11F

It was shown by spectroscopic investigations that diffusion processes play a secondary role in the entry of the constituent materials of a specimen into the discharge cloud in alloys with a pronounced intercrystal diffusion. A dendrite etching of copper alloys by an electrical discharge was found experimentally. This phenomenon is more clearly observed in alloys with horophile elements which facilitate the occurrence of complex physico-chemical processes in interdendrite zones and in the boundaries of crystallites. Author (GRA)

N71-25707# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
ON RADIATION-ENHANCED CREEP
M. F. Ashby Feb. 1971 17 p refs
(Contracts N00014-67-A-0298-0020; DAHC15-67-C-0219)
(AD-719905; TR-4) Avail: NTIS CSCL 20/12

A physical model for a mechanism by which a flux of neutrons can enhance the creep rate of a material leads to a creep rate which is linear in stress. The radiation-induced climb of dislocations or dislocation loops is biased by a small applied stress. At steady state, the density of climbing dislocations depends on the generation rate of point defects. The model leads to a creep rate which may be almost independent of temperature. Author (GRA)

N71-25739# Joint Publications Research Service, Washington, D.C.
MEASURING PHOTOCONDUCTIVITY OF SEMICONDUCTORS IN THE MICROWAVE BAND
Ye. A. Sokolov et al 29 Apr. 1971 7 p refs Transl. into ENGLISH from Prib. Tekh. Eksp. (USSR), no. 4, 1967 p 141-143
(JPRS-53000) Avail: NTIS

A description is given of a device for studying the photoconductivity of organic semiconductors and other materials with low losses in the 3-cm band. The frequency of the superhigh frequency generator is stabilized by the operating resonator E sub 010 in the transfer circuit. The photoeffect signal is observed in the reflection channel of the T-T bridge with auxiliary superhigh frequency balance and feeding the superhigh frequency bias to the receiving detector. The sensitivity of the device on varying tg delta exceeds 2.10 to the minus 7th power. The schematic of a kinetic device with time resolution of 3.10 to the minus 8th power seconds based on illumination of the sample by a flash of light and direct amplification of the superhigh frequency signal in a traveling wave tube is presented. Author

N71-25762*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GROWTH OF BORON DOPED DIAMOND BY VAPOR DEPOSITION
David J. Poferl (Ph.D. Thesis - Case Western Reserve Univ.) Jun. 1971 157 p refs
(NASA-TM-X-67866) Avail: NTIS CSCL 20B

The growth of p-type semiconducting diamond by vapor phase deposition using a methane-diborane doping gas mixture in the presence of diamond seed crystals is discussed. Diamond is an insulator at room temperature due to the relatively large intrinsic conduction energy gap of approximately 5.6 eV between the valence and conduction bands. Semiconducting diamond can be obtained by introducing appropriate impurities, such as boron, into the diamond lattice. Author

N71-25764# Stanford Univ., Calif. Center for Materials Research.
NEW SUPERCONDUCTORS Semiannual Technical Report, 1 Aug. 1970 - 31 Jan. 1971
William A. Little 31 Jan. 1971 117 p refs
(Contract N00014-67-A-0112-0056; ARPA Order-1681)
(AD-720776; SU-CMR-71-5; SATR-1) Avail: NTIS CSCL 7/2

The report consists of four principal sections: A theory section concerned with the development of accurate methods for determining the polarizability of large organic molecules, the

extension of existing band theory methods to linear systems, and the development of means of using these properties for the calculation of the transition temperature of any superconducting phases; a synthesis section involved in the synthesis of transition metal linear organometallic systems of crystalline or covalently bound structures and with special ligand systems for control of the electronic environment of the metal atoms; an x-ray section for determining the structure of crystalline samples; and an experimental section for determining the material parameters of the prepared materials as functions of temperature and pressure. Author (GRA)

N71-25773*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECTIVE SEPARATION TECHNIQUE FOR SMALL DIAMETER WHISKERS

Leonard J. Westfall Apr. 1971 15 p refs

(NASA-TM-X-67843) Avail: NTIS CSCL 20L

Alumina whiskers are highly desirable reinforcement fibers for composite materials. However, whiskers of long length and high strength must be separated from the tangled matt in which they are grown to permit fabrication of strong composites. A successful method for separating small diameter whiskers from as-grown matt was developed. Fifty percent by volume of the separated whiskers had an L/D ratio of 300 or greater. Room temperature tensile strengths of 783,000 psi to 1,704,000 psi were measured for separated whiskers. The separation process produced 48 percent useful whiskers. Author

N71-25809# Lincoln Lab., Mass. Inst. of Tech., Lexington.

THE GRADED GAP SEMICONDUCTOR PHOTOEMITTER

Ivars Melngailis 22 Jan. 1971 31 p refs

(Contract F19628-70-C-0230)

(AD-720796; TN-1971-8; ESD-TR-71-8) Avail: NTIS CSCL 9/1

A new scheme is proposed for achieving photoemission from semiconductors at infrared wavelengths from about 1 micrometer to well beyond 10 micrometers. The device consists of a graded-energy-gap p-type semiconductor with a low work function coating on the wide-gap side. Electrons, which are photoexcited from the valence to the conduction band by long wavelength radiation in the narrow-gap region are drifted by an applied electric field into the wide-gap region from where they are emitted into vacuum. Graded-gap Hg(x-1)Cd(x)Te is considered for a photoemitter covering wavelengths to about 12 micrometers and both Ga(1-x)In(x)As and InAs(x)P(1-x) are proposed as possible alloys for 3 micrometers photoemission. For the simplest case of a linearly graded gap and a constant conductance, expressions are derived for the length of the graded region required to minimize power dissipation and for the speed of response. A calculation is also made of the dark current which results from thermal generation in the narrow-gap region in order to determine the operating temperature required for achieving a desired noise-equivalent power at any wavelength. Author (GRA)

N71-25912# Northeastern Univ., Boston, Mass. Dept. of Mechanical Engineering.

STUDIES OF DEFORMATION UNDER HYDROSTATIC PRESSURE Final Report

Richard J. Murphy, Welville B. Nowak, and Frederic M. Glock 2 Jan. 1971 40 p refs

(Contract Nonr-4106(03))

(AD-720415) Avail: NTIS CSCL 20/12

Single crystals of NaCl were deformed by fluid-to-fluid extrusion and uniaxial compression under hydrostatic pressure at ambient temperature. The effect of pressure on the deformation and fracture was studied. Wavy slip was observed in crystals extruded at pressures above 10 kbar indicating the operation of <110>{001} slip. Cracking occurred on {110} planes as well as the {100} cleavage planes. <111> cylindrical crystals deformed by uniaxial compression were ductile above 7 kbar and exhibited <110>{001} straight slip. Author (GRA)

N71-25974*# Massachusetts Inst. of Tech., Cambridge. Dept. of Physics.

SOLID STATE AND MOLECULAR THEORY GROUP Semiannual Progress Report

15 Jul. 1970 49 p refs

(Grant NGR-22-009-483; Contracts F44620-69-C-0054; ARPA SD-90; Grants NSF GP-7677; NSF GP-15428)

(NASA-CR-118635; SAPR-73) Avail: NTIS CSCL 20L

Continuing research in solid state physics and molecular theory is reported. Separate sections deal with the following: (1) SCF molecular-orbital studies of the sulfate ion by the scattered wave model, (2) computational aspects of the augmented plane wave (APW) method, (3) a non-spherical modification to the APW method, and (4) Casimir invariants as invariant operators in Lie groups. D.L.G.

N71-26020# California Univ., Los Angeles. Dept. of Physics.

A THEORETICAL STUDY OF THE MAGNETIC PROPERTIES OF SOLIDS Terminal Report, 1 Sep. 1969 - 31 Aug. 1970

Raymond Orbach and Philip Pincus 31 Aug. 1970 26 p refs

(Contract N00014-69-A-0200-4008)

(AD-720777) Avail: NTIS CSCL 20/12

The document lists published articles and articles submitted for publication under the contract. A partial listing includes the following: Electron spin resonance in dilute magnetic alloys, The Anderson model in a nonorthogonal representation, Hyperfine Splitting of a localized moment in a metal, Conduction electron resonance line width in dilute magnetic alloys above the Kondo critical field at very low temperatures, Resonant scattering by impurities in metals and the Anderson model, Electron tunneling and band structure of SrTiO3 and KTaO3, Critical concentration for single ion-single ion energy transfer in ruby, Dynamics of localized moments in metals; Influence of spin-orbit scattering on the s-d exchange model, Magnetic properties of liquid crystals, Boson theory of angular momentum: Heisenberg ferromagnetism at low temperatures, Superconductivity of jupiter, and Nuclear relaxation in dilute magnetic alloys. GRA

N71-26050*# Michigan Univ., Ann Arbor. Electron Physics Lab.

BULK SEMICONDUCTOR MATERIALS FOR MILLIMETER AND SUBMILLIMETER WAVE DETECTION

I. I. Eldumiati (Ph.D. Thesis) Dec. 1970 231 p refs

(Grant NGL-23-005-183)

(NASA-CR-118507; TR-118) Avail: NTIS CSCL 20L

The properties of bulk semiconductor materials were investigated for application as millimeter- and submillimeter-wave detectors using a downconversion process. The hot-electron effect serves as the process responsible for the detection mechanism. Power applied at the millimeter-wave frequency causes a change in the material conductivity, which in turn causes a change in the microwave power absorption. Millimeter- and submillimeter-wave detection is achieved by monitoring the corresponding change in the microwave power absorption. In order to determine the characteristics of the downconverter, a thorough study of the properties of shallow-type impurity semiconductors in the presence of microwave and dc magnetic fields was carried out as a function of temperature (4.2 to 300 K). Measurements using cavity perturbation techniques were used to determine the properties of the material and the theoretical and experimental results were compared. The hot-electron effect was found to be insignificant above liquid nitrogen temperature and the scattering mechanisms were dominated by acoustic and polar modes over the same temperature range. Author

N71-26147# Harry Diamond Labs., Washington, D.C.

AN ANALYSIS OF MEASUREMENTS OF ELECTRON DRIFT VELOCITY IN SILICON AT HIGH FIELDS

Alford L. Ward Mar. 1971 11 p refs

(AD-720543; HDL-TM-70-35) Avail: NTIS CSCL 20/12

An existing computer program is employed to check the validity of an analytic expression used by Tove et al to determine the velocity of electrons as a function of field from time-of-flight current pulses measured in silicon diodes. An alternate analytic expression is introduced for that field range where the velocity is nearly proportional to the square root of the field. Author (GRA)

N71-26287 California Univ., Berkeley.
RADIATION DAMAGE IN MINIATURE AVALANCHE DIODES
Reid Robert Samuelson (Ph.D. Thesis) 1969 216 p
Avail: Univ. Microfilms Order No. 70-13157

The diodes were operated in a pulse mode in which the avalanche is self-quenching in a manner analogous to the operation of a Geiger - Mueller tube. The pulse rate due to a constant carrier generation rate was experimentally and theoretically shown to be proportional to the voltage pulse height. The pulse rate due to radiation induced defects increased more rapidly than linearly with voltage. This was in part attributable to carrier trapping effects. The occurrence of trapping was established by an increase in the pulse rate with capacitance. In some circumstances the pulse rate was attributable to trapped carriers which tunneled from defects. This was determined by the reduction of carrier emission with a reduction of the bias voltage. The voltage dependence of the pulse rate of heavily electron irradiated diodes was exponential, which was in accord with an elementary theory of tunneling from defects. However there was significant quantitative disagreement which indicated that the theory was incomplete. Dissert. Abstr.

N71-26348 Cornell Univ. Ithaca, N.Y.
ANALYSIS OF SPACE GROUP SYMMETRY, POLYTYPISM, LAYER TWINNING AND STACKING: APPLICATION TO ALUMINUM BORIDE STRUCTURES
Leung-Tak Tai (Ph.D. Thesis) 1969 240 p
Avail: Univ. Microfilms Order No. 70-5782

A group theoretical treatment for the symmetry analysis of layer stacking, layer twinning and polytypic structures was developed. The analysis proceeds in two steps: the first involves a formulation of the cell relationships between parent and composite lattices as a function of the stacking operator and the second involves the determination of the composite space group for the resulting structure. The plan lattice corresponding to a general layer of structure parallel to any given (h k l) plane in the parent structure is determined and the reduced Bravais lattice generated by the operation of an appropriate stacking operator on this layer is determined in a generalized Delaunay reduction. The symmetry of the general layer of structure corresponds to one of the 80 sectional plane groups. The concepts of similarity transformation of symmetry elements are emphasized in performing the symmetry analysis. A number of known examples are included for illustration, and the technique is applied to alpha- and gamma-A1B 12 in an analysis of their partial structures. Dissert. Abstr.

N71-26349 Virginia Univ., Charlottesville.
THE INFLUENCE OF THIN EPITAXIAL SURFACE FILMS ON THE PLASTIC PROPERTIES OF COPPER
George Edward Ruddle (Ph.D. Thesis) 1969 288 p
Avail: Univ. Microfilms Order No. 70-8088

The influence of a thin epitaxial surface film on the early stages of plastic deformation of copper single crystals was investigated. The experimental evidence was interpreted in terms of the factors influencing dislocation glide in the surface region of the substrate-film composite. Composite crystals formed by electrodeposition of 600 A thick films of nickel, gold, and alpha-brass onto copper substrates of a single slip axial orientation and specific surface orientations was deformed in tension and compared with equivalent unplated copper crystals. The effect of the epitaxial surface film on the yield behavior of copper varied with the film material, the surface orientation of the substrate crystal, and the substructure of the substrate. Examinations of the structure and epitaxial relationship of the surface film by electron diffraction, and of the slip structure of the film surface by replica electron microscopy, were correlated with the stress-strain data in the investigation of the mode of dislocation glide through the surface of the composite. Dissert. Abstr.

N71-26350 Minnesota Univ., Minneapolis.
FLUCTUATIONS IN p-n JUNCTIONS AT HIGH INJECTION LEVELS
Ming Liang Tarng (Ph.D. Thesis) 1969 121 p
Avail: Univ. Microfilms Order No. 70-5613

The fluctuations in one dimensional p-n junction diodes at the high injection limit were investigated. Noise sources were derived for a general transport process with no specific restrictions. The ambipolar transport equations for fluctuating electrons and holes are formulated. The source functions and the transport equations are then simplified by applying the general expression to a one dimensional junction device operating in the high injection limit. A unique density correlation function of this system is then obtained from the A-theorem. The noise spectrum of the carrier fluctuations was obtained by two methods: (1) the density correlation function, and (2) the noise sources. The spectrum of the current fluctuations representing the short circuited noise across the junction admittance was derived. Dissert. Abstr.

N71-26456# Joint Publications Research Service, Washington, D.C.
PROCESSES OF LUMINESCENCE IN SOLIDS
S. Z. Roginskiy et al *In its* Vestn. of the USSR Acad. of Sci., Vol. 40, No. 6, 1970 31 Aug. 1970 p 93-102 refs (See N71-26452 14-30)
Avail: NTIS

Data are presented that show two types of luminescence upon contact of gases with solids: the chemiluminescence of two dimensional processes in which chemisorption and catalysis are included, and luminescence that arises as a result of electrical discharge in a gaseous medium under the influence of surface charges. G.G.

N71-26480# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
THE UPPER BISMUTH PRESSURE CALIBRATION POINT
J. C. Haygarth, H. D. Luedemann, I. C. Getting, and G. C. Kennedy *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 35-38 refs (See N71-26476 14-12)
Avail: SOD $4.50

The Bi III-V and IV-V equilibrium boundaries were studied by monitoring electrical resistance changes. Extrapolation of the III-V data to 25 C yields an equilibrium transition pressure of 77.5 + or - 1.0 kbar. The extrapolation also agrees within experimental error with the pressure of 78.2 kbar determined in a separate experiment at 22 C. The use of the transition as a calibration point is discussed, and a procedure for estimating the compression stroke transition pressure from the equilibrium transition pressure is proposed. Author

N71-26489# Naval Ordnance Lab., White Oak, Md.
EQUATIONS OF STATE FOR SODIUM AND ALUMINUM
D. John Pastine and M. J. Carroll *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 91-104 refs (See N71-26476 14-12)
Avail: SOD $4.50

Equations of state are calculated for sodium and aluminum. In each case this is done by first calculating the 0 K isotherm and then adding the thermal contributions to the pressure. The calculations in both cases are theoretical and very few experimental data are used. Comparisons of theoretical prediction and experimental data are very favorable. Author

N71-26490# National Bureau of Standards, Washington, D.C.
AN ATOMISTIC THEORY OF SHOCK COMPRESSION OF A PERFECT CRYSTALLINE SOLID
D. H. Tsai *In its* Accurate Characterization of the High Pressure Environment Mar. 1971 p 105–123 refs (See N71-26476 14-12)
Avail: SOD $4.50

Lattice dynamical calculations have been employed to study the process of compression of a perfect, two dimensional, fcc lattice by a strong shock wave. The interaction energy between the lattice points is assumed to be the Morse-type potential function, and the interaction is assumed to extend to the fourth nearest neighbors. The formulation of the dynamical problem is described. The details of the computation of the shock wave stress and density profiles, shock velocity, energy density profile, local energy distribution, velocity distribution, and the components of the Grueneisen parameter are discussed. Of special interest is the thermal relaxation process behind the shock front. It is found that relaxation time is not constant, and that the steady, relaxed region in the shock profile trails farther behind the shock front with increasing time. The implications of these results on the calculation of the high pressure equation of state of a crystalline solid are examined. Author

N71-26494# Los Alamos Scientific Lab., N.Mex.
THE EQUATION OF STATE OF SELECTED MATERIALS FOR HIGH PRESSURE REFERENCES
W. J. Carter, S. P. Marsh, J. N. Fritz, and R. G. McQueen *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 147–158 refs (See N71-26476 14-12)
Avail: SOD $4.50

Experimental techniques are reported which measure directly both the shock velocity and material velocity needed to establish pressure-compression curves through the Rankine-Hugoniot equations for developing high pressure standards. Direct or primary standards established are deoxidized copper and 2024 aluminum alloy; equations of state of other materials are measured relative to the standards through the impedance match method. Calculated isotherms are compared with the Bridgeman isothermal data and show good agreement for most materials to pressures of 30 kbar. G.G.

N71-26495# Tokyo Univ. (Japan). Inst. for Solid State Physics.
EFFECT OF PRESSURE ON THE LATTICE PARAMETERS OF LEAD CHALCOGENIDES AND NICKEL ARSENIDE TYPE COMPOUNDS
S. Minomura, H. Nagasaki, and I. Wakabayashi *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 159–166 refs (See N71-26476 14-12)
Avail: SOD $4.50

The lattice parameters have been measured in two lead chalcogenides (PbS and PbTe) up to 90 kbar and in four nickel arsenide-type compounds (MnSb, MnTe, CrSb, and CrTe) up to 170 kbar. Author

N71-26496# Battelle Memorial Inst., Columbus, Ohio.
THE COMPRESSIBILITY AND THERMAL EXPANSION OF LiF TO 60 kbar AND 600 C AS DETERMINED BY X-RAY DIFFRACTION Progress Report
L. C. Carrison and C. B. Sclar *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 167–172 refs (See N71-26476 14-12)
Avail: SOD $4.50

Measurements were made of the compressibility of LiF to 60 kbars over the temperature range 25 C to 600 C by high pressure high temperature X-ray powder diffraction methods. Pressures were determined by using NaCl as an internal calibrant. These results also provide data on the thermal expansion of LiF between 25 and 600 C at pressures of 38 and 57 kbar. The feasibility of determining the unit-cell volume of crystalline solids under concomitant high pressure and high temperature by in situ X-ray methods is demonstrated. Author

N71-26497# Pennsylvania State Univ., University Park. Materials Research Lab.
ULTRASONIC AND STATIC EQUATION OF STATE FOR CESIUM HALIDES
G. R. Barsch *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 173–187 refs (See N71-26476 14-12)
Avail: SOD $4.50

A three parameter equation of state based on ultrasonically measured values of the bulk modulus and its first two pressure derivatives has been proposed for CsCl and CsBr at room temperature, and for CsI between 0 C and 600 C. The phenomenological equation of state of Birch has been used in the second order approximation and has been found to be superior to the equations of Murnaghan and Keane. The ultrasonic equation of state does not agree within the carefully established limits of experimental error with the piezometric data of Bridgman, but it does agree up to 400 kbar with data obtained from high pressure X-ray measurements. Even at these high pressures the accuracy of the ultrasonic equation of state is better than that of the X-ray data. Author

N71-26498# Rochester Univ., N.Y. Dept. of Geological Sciences.
CALCULATION OF THE P-V RELATION FOR SODIUM CHLORIDE UP TO 300 KILOBARS AT 25 C
J. Scott Weaver, Taro Takahashi, and William A. Bassett *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 189–199 refs (See N71-26476 14-12)
(Grants NSF GP-5304; NSF GA-1430)
Avail: SOD $4.50

The P-V relation for the BI phase NaCl was calculated up to 300 kilobars at 25 C by means of the Hildebrand and Mie-Grumeisen equations. The effects of: (1) the uncertainty in the parameters used; (2) the functional form for the temperature dependent part of internal energy; (3) the anharmonic contribution; and (4) the second nearest neighbor repulsion on the calculated P-V relation are discussed. It was found that the calculated P-V relation for NaCl is sensitive to the value chosen for Bt sub 0, and that the effects of (2), (3), and (4) on the calculated P-V relation are small. The precision for the present calculation has been estimated to be + or − 2.5 percent. Simultaneous determinations of the effects of pressure on the volumes of NaCl and MgO were made by X-ray diffraction on an intimate mixture of these two materials. It was found that the pressure values calculated from the volume of NaCl using the calculated P-V relation are in agreement with those calculated from the volume MgO using the P-V relation calculated from the values of Bt sub 0 and Bt sub 0 with the Murnaghan equation. This agreement verifies not only the calculated P-V relation for NaCl, but also establishes the validity of the internal standard method for pressure determination. Author

N71-26499# Los Alamos Scientific Lab., N.Mex.
THE HUGONIOT EQUATION OF STATE OF SODIUM CHLORIDE IN THE SODIUM CHLORIDE STRUCTURE
J. N. Fritz, S. P. Marsh, W. J. Carter, and R. G. McQueen *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 201–208 refs (See N71-26476 14-12)
Avail: SOD $4.50

The Hugoniot equation of state of NaCl has been obtained by measuring the shock velocity through NaCl on copper and 2024 aluminum base plates. Shock velocities through the base plates and standard impedance matching were used to obtain the Hugoniot curves for both single crystal and pressed powder samples. The smooth behavior of the resulting shock locus up to 230 kbar indicates that NaCl exists in the sodium chloride structure up to this pressure. In the shock particle velocity plane the best linear fit to the data reported here is u sub s

(km/s) = (3.528 + or - 012) + (1.343 + or - .009) u sub p. A quadratic fit, which gives a large weight to the measured bulk sound speed in NaCl, is u sub s = 3.403 +1.5422 u sub p -0.7345 u2 sub p. Isotherms at 293 K, using different forms for the Gruneisen parameter and a simple Debye model for the specific heat, are calculated from the Hugoniots and are presented here. They should prove useful when NaCl is used as an internal standard in high pressure X-ray devices. Author

N71-26500*# Lamont Geological Observatory, Palisades, N.Y.
CONSISTENCY IN THE HIGH TEMPERATURE EQUATION OF STATE OF SOLIDS
Leon Thomsen and Orson L. Anderson *In* NBS Accurate Characterization of the High Pressure Environment Mar 1971 p 209-217 refs (See N71-24746 14-12)
(Grant NGR-33-008-012; Contract F44620-68-C-0079; Grant NSF GA-1208)
(NASA-CR-118666) Avail: SOD $4.50 CSCL 20L

Four equations of state for solids are examined theoretically for mutual consistency in the high temperature regime. It is found that neither the Birch-Murnaghan nor the Murnaghan equation can be shown to be consistent with either the Mie-Gruenisen or the Hildebrand equation. An expression is derived for the volume dependence of the Gruenisen parameter gamma(rho). A recent theoretical treatment of NaCl, proposed for use as a pressure standard, is neither internally consistent, nor is it sufficiently precise for such a purpose. Author

N71-26501*# Los Alamos Scientific Lab., N.Mex.
THE SOLID LIQUID PHASE LINE IN Cu
R. G. McQueen, W. J. Carter, J. N. Fritz, and S. P. Marsh *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 219-227 refs (See N71-26476 14-12)
Avail: SOD $4.50

Hugoniot and zero pressure data are used to calculate the shock strength required to melt copper on the pressure release wave from shock loading. The solid-liquid phase line of copper is then found by applying the Hugoniot equation of state for the liquid phase, Hugoniot measurements at low initial density, and the Gruneisen function for high pressure dynamics. G.G.

N71-26502*# Sandia Corp., Albuquerque, N.Mex.
SHEAR STRENGTH EFFECTS PHASE TRANSITION PRESSURES DETERMINED FROM SHOCK COMPRESSION EXPERIMENTS
O. E. Jones and R. A. Graham *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 229-242 refs (See N71-26476 14-12)
Avail: SOD $4.50

The effects of the nonzero shear strength of a solid on the measured shock transition stress are discussed, and methods are outlined for calculating the isotropic pressure component needed for comparison with hydrostatic results. Comparison requires that the compression to initiate the transition be independent of shear distortion. The shock propagation characteristics of a solid which are necessary for establishing a reliable equilibrium transition pressure are considered. Existing Hugoniot elastic limit data permit the importance of shear strength to be assessed for various materials. Shock compression data for phase transitions in Bi, Fe, Ge, CdS, and InSb are analyzed and shear strength corrections applied to obtain transition pressures. Author

N71-26503*# Sandia Corp., Albuquerque, N.Mex.
STUDY OF PHASE TRANSITIONS IN INSULATORS BY THE DIELECTRIC CONSTANT TECHNIQUE
G. A. Samara and W. L. Chrisman *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 243-250 refs Sponsored by AEC (See N71-26476 14-12)
Avail: SOD $4.50

Measurements of dielectric constant and dielectric loss as a probe for detecting and studying the properties of pressure induced phase transformations in insulators are proposed. The measurement is very sensitive, relatively simple, and can be adapted for use in many types of high pressure apparatus. To illustrate the general usefulness of the technique, results on a variety of substances (solids and liquids) obtained from measurements in three different pressure devices are presented and discussed. The substances investigated include a number of alkali and thallous halides, strontium titanate, and water. Author

N71-26505*# National Research Lab. of Metrology, Tokyo (Japan).
FIXED POINTS ON THE HIGH PRESSURE SCALE IDENTIFIED BY PHASE TRANSITIONS IN AMMONIUM FLUORIDE
R. Kaneda, S. Yamamoto, and K. Nishibata *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 refs p 257-262 (See N71-26476 14-12)
Avail: SOD $4.50

The I-II and II-III transitions in NH4F, as fixed points on the high pressure scale, have been investigated under purely hydrostatic conditions at the temperatures of 0, 25 and 50 C. By means of manganin resistance gages, the transition pressures at 25 C have been determined to be 3605 + or - 10 bar for the I-II and 11531 + or - 23 bar for the II-III. Their respective dependences on temperature are + 2.5 bar/degree C and + 20.7 bar/degree C. The realization of both transition points is easy at and above room temperature, but at low temperatures the II-III transition is very sluggish. Author

N71-26506*# General Electric Co., Schenectady, N.Y. Research and Development Center.
REVIEW OF RESISTANCE JUMP PHASE CHANGES USEFUL FOR HIGH PRESSURE CALIBRATION
F. P. Bundy *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 263-271 refs (See N71-26476 14-12)
Avail: SOD $4.50

The most commonly used high pressure calibrating materials are listed and pertinent information about them is summarized. The absolute accuracies to which the various transition pressures are known are discussed together with the necessary precautions in applying this method of pressure calibration to different kinds of cell geometries in various apparatuses. Author

N71-26507*# Tokyo Univ. (Japan). Inst. for Solid State Physics.
THE COESITE-STISHOVITE TRANSITION
Syun-Iti Akimoto and Yasuhiko Syono *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 273-278 refs (See N71-26476 14-12)
Avail: SOD $4.50

The coesite-stishovite transition curve has been determined over the temperature range 550 to 1,200 C in the pressure range 82.0 to 98.0 kbar by means of a tetrahedral-anvil type of high pressure apparatus. Amorphous anhydrous silica, alpha-quartz, coesite, and stishovite were used as starting materials. The transition curve was fitted by linear equation using a pressure scale. This determination was found to be in reasonable agreement with previous data, if the common pressure scale is used. Experimental information for the coesite-stishovite transition was also compared with the stability relation derived from enthalpies and entropies of coesite and shishovite. It was suggested that the pressure scale proposed by Jeffery et al. was underestimated considerably around 100 kbar. Author

N71-26508*# Battelle Memorial Inst., Columbus, Ohio.
THE USE OF SOLID SOLID TRANSITIONS AT HIGH TEMPERATURES FOR HIGH PRESSURE CALIBRATION
Phillip N. La Mori *In* NBS Accurate Characterization of the High

Pressure Environment Mar. 1971 p 279–282 refs (See N71-26476 14-12)
Avail: SOD $4.50

Transition pressures have been determined for bismuth 1 to 2 and bismuth 2 to 3 to the melting point (183 C). The transitions parameters of thallium 2 to 1, 1 to 3 and 2 to 3 have been measured to 40 kbar and 220 C. The thallium 1 to 2 to 3 triple point has been determined as 114 + or − 1 C and 37.4 + or − 0.4 kbar. The use of the determined transition parameters as high pressure, high temperature fixed points is discussed. Author

N71-26510# Commissariat a l'Energie Atomique, Paris (France). Centre d'Etudes de Bruyeres-le-Chatel.
TRANSITION PRESSURES OF Bi 3-5, Sn, and Fe
M. Contre *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 291–296 refs (See N71-26476 14-12)
Avail: SOD $4.50

Making use of an X-type anvil, the change in resistance of two reference metals in each run was simultaneously recorded in order to compare their transition pressures. A linear extrapolation through the well known points below 60 kbar showed inconsistencies in the most commonly used high pressure scales. The recording of the pistons' displacements led to an exponential extrapolation which gave transition pressure of 78 + or − 2 kbar for Bi 3-5, of 102 + or − 4 kbar for Sn, and of 140 + or − 15 kbar for Fe. Author

N71-26514# Rochester Univ., N.Y. Dept. of Geological Sciences.
COMPARISON OF FOUR PROPOSED P-V RELATIONS FOR NaCl
J. Scott Weaver *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 325–330 refs (See N71-26476 14-12)
Avail: SOD $4.50

Some comparisons among four P-V relations for the B1 phase of NaCl discussed at this symposium are presented. The two scales proposed by Weaver and a 1968 revision of Decker's P-V relation are shown to agree closely. The three models yield zero pressure thermal expansion curves in reasonable agreement with experiments, but give values for B' sub 10 smaller than the measured values. This appears to be due in part, to the form used for the lattice energy. The three models yield pressures about 2.5 percent smaller than those calculated for the pressure scale based on Hugoniot data. Comparison of the models suggests that part of this difference must result from either the form chosen for the lattice energy or from the Hugoniot data. It is concluded that, since the differences among these scales are comparable to the experimental uncertainties involved in applying them, and since there is no compelling reason to choose one over the others, any of these scales may be used for the present. Author

N71-26543# Forsvarets Forskningsanstalt, Stockholm (Sweden). Avdelning 4.
SOME POINTS OF VIEW ON THE CHARACTER AND TENDENCIES IN SOLID STATE PHYSICS TOGETHER WITH THEIR SIGNIFICANCE FOR KNOWLEDGE OF THE PROPERTIES OF MATERIALS [NAGRA SYNPUNKTER PA KARAKTAEREN HOS OCH TENDENSER INOM FASTA TILLSTANDETS FYSIK SAMT DESS BETYDELSE FOER MATERIALKUNSKAP]
B. Johansson Oct. 1969 12 p In SWEDISH
(FAO-4-C-4404-10) Avail: NTIS

The general significance of solid state physics for knowledge of the properties of materials is illustrated and discussed from a theoretical point-of-view by means of concrete examples. It is established that development within solid state physics makes it probable that this most important concept will become more and more significant in progressive knowledge of materials. It is further established that calculations of material parameters, including atomic properties, can be realized to a far greater extent. Author

N71-26568# Massachusetts Inst. of Tech., Cambridge. Center for Materials Science and Engineering.
STUDIES OF MAGNETOSTATIC WAVES AND MAGNETOELASTIC WAVES IN YTTRIUM-IRON GARNET CRYSTALS USING OPTICAL PROBING AND MICROWAVE TECHNIQUES Semiannual Technical Report, 1 Aug. 1970–1 Feb. 1971
Hung-Liang Hu (Ph.D. Thesis) and Frederic R. Morgenthaler 15 Mar. 1971 188 p refs
(Contract DAHC15-70-C-0190; ARPA Order 1512)
(AD-720388; SATR-2) Avail: NTIS CSCL 20/12

The report describes in detail the technical progress made in studies of strong infrared light scattering from coherent spin waves during the second six months of a three year interdisciplinary research program. Coherent light scattering from coherent microwave spin waves in yttrium iron garnet (YIG) is studied theoretically and experimentally. The method is then used, in conjunction with standard microwave techniques, to probe the propagation of spin waves and magnetoelastic waves, in spatially-and/or-temporally-varying magnetic fields. The dispersion of magnetoelastic waves propagating parallel to saturation magnetization when the latter is in an arbitrary crystallographic direction, first presented by Morgenthaler, is rederived. The report discusses the first direct observation of strong Bragg Scattered infrared light (1150 nm wavelength) from coherent microwave spin waves. GRA

N71-26584# Lyon Univ. (France) Inst. de Physique Nucleaire.
OXYGEN DETERMINATION IN SILICON BY MEANS OF ALPHA PARTICLES [CONTRIBUTION AU DOSAGE DE L'OXYGENE DANS LE SILICIUM AU MOYEN DES PARTICULES ALPHAS]
J. Giroux, M. Talvat, J.-P. Thomas, and J. Tousset 6 Jul. 1970 25 p refs In FRENCH; ENGLISH summary
(LYCEN-7060) Avail: AEC Depository Libraries

The determination of low oxygen contents in silicon by alpha activation is based on the Engelmann's method. The influence of the energy distribution on the activation curves was investigated. Some complex phenomena arising between 54 and 40 MeV explain the production profiles of F-18 and the other radioisotopes. Some details are given about the microanalysis of the surface oxide layers. Diffusion of oxygen or F-18 nuclides induced at the surface during the irradiation does not explain production of this radioisotope in the matrix. Parasitic reactions on the matrix are avoided by using other conditions of irradiation; the best energy range being about 35 MeV. Some results of the analysis are given. NSA

N71-26603# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIATION EFFECTS IN ESPECIALLY PURE SILICON
S. V. Starodubtsev et al 11 Dec. 1970 10 p ref Transl. into ENGLISH from the Russian
(AD-720753; FTD-HT-23-583-70) Avail: NTIS CSCL 20/12

Silicon single crystals were obtained by means of non-crucible zone melting of very pure initial polycrystalline material. In such specimens the lifetime of minority carriers is up to 1000 microsec. It is found that variations in current carrier concentration occur differently for the different specimens. In the initial instant at low doses, the most effective yield is obtained by the oxygen complex levels, related to residual oxygen. In this case a decrease in hole concentration takes place. As the deep acceptor levels are accumulated and oxygen is depleted, a gradual increase in hole concentration takes place. Measurement of the temperature dependence of carrier concentration for pure specimens indicated

the appearance of deep levels in the forbidden zone as a result of gamma-radiation. In standard specimens no defect levels are observed in this temperature range. Author (GRA)

N71-26619 California Inst. of Tech., Pasadena.
AN EXPERIMENTAL STUDY OF THE MOBILITY OF EDGE DISLOCATIONS IN PURE COPPER SINGLE CRYSTALS
Kenneth Mark Jassby (Ph.D. Thesis) 1970 71 p
Avail: Univ. Microfilms Order No. 70-12443

The velocity of selectively-introduced edge dislocations in 99.999 percent pure copper crystals has been measured as a function of stress at temperatures from 66 K to 373 K by means of a torsion technique. The range of resolved shear stress was 0 to 15 megadynes/sq cm for seven temperatures. Dislocation mobility is characterized by two distinct features: (1) relatively high velocity at low stress (maximum velocities of about 9000 cm/sec were realized at low temperatures), and (2) increasing velocity with decreasing temperature at constant stress. The experimental dislocation behavior is consistent with an interpretation on the basis of phonon drag. However, the complete temperature dependence of dislocation mobility could not be closely approximated by the predictions of one or a combination of mechanisms. Dissert. Abstr.

N71-26631 Virginia Univ., Charlottesville.
THE DEPENDENCE OF NEUTRON RADIATION DAMAGE IN METALS ON CRYSTAL LATTICE GEOMETRY
Francis Albert Garner (Ph.D. Thesis) 1969 257 p
Avail: Univ. Microfilms Order No. 70-8091

Transmission electron microscopy was employed to study the nature and distribution of the damage produced by fast neutrons in nickel and copper. The distribution and density of the resultant dislocation loops in the vicinity of various crystal boundaries, particularly crystal surfaces and coherent twin boundaries are discussed. Bulk nickel, electrochemically thinned for observation, was employed in addition to a wide variety of vapor deposited thin films. The thin films had been subjected to various deposition conditions and annealing treatments to yield films with a high density of coherent twin boundaries and a low density of strain imperfections. Some films were also produced that had internal surfaces such as voids and web holes. Dissert. Abstr.

N71-26632# DuPont de Nemours (E. I.) and Co., Buffalo, N.Y.
ORIENTATION EFFECTS IN BIAXIALLY STRETCHED LINEAR POLYETHYLENE
G. C. Adams [1970] 13 p refs *Its* Publ. Proposal No. 295-W
Avail: NTIS

The biaxial stretching of linear polyethylene above room temperature is generally considered difficult because of high crystallinity. This polymer has been biaxially stretched at 128 C using simultaneous stretching in two perpendicular directions to stretch ratios up to 6 × 6. The biaxially oriented films have been studied by x-ray photographs and by quantitative intensity scans appropriate to biaxially stretched films. The orientation effects are discussed and compared with one-way stretched, bulk crystallized polyethylene and polyethylene single crystal mats and with biaxially oriented polypropylene. Author

N71-26633 North Carolina State Univ., Raleigh.
ELECTRICAL CONDUCTION ACROSS A THIN FILM Au-CdS INTERFACE
George Walter Hoyle (Ph.D. Thesis) 1970 99 p
Avail: Univ. Microfilms Order No. 70-12830

The volt-ampere characteristics of deposited thin-film Au-CdS-In structures are examined at power levels less than 300 microwatts over a temperature range of 200 K. This investigation reveals that the Au-CdS interface forms a partially blocking contact which does not conform to classical theories of electron flow across a metal-semiconductor interface. Experimentally observed data show that current varies subexponentially with applied forward bias (Au positive with respect to CdS) and linearly with applied reverse bias (Au negative with respect to CdS). In addition, plots of the logarithm of amperage versus forward bias show unusual curvature for low bias levels and straightline segments for larger bias levels. These straightline segments have temperature insensitive slopes an order of magnitude smaller than that predicted by classical theory. Dissert. Abstr.

N71-26770# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
PROPERTIES OF ION IMPLANTED Zn-Te
J. Marine 26 Oct. 1970 8 p refs Presented at European Conf. on Ion Implantation, Reading, England, 7–9 Sept. 1970
(CEA-CONF-1719; CONF-700945-1) Avail: AEC Depository Libraries

P-type ZnTe crystals were implanted by chlorine ions in order to create n-type layers. Ion implantation and annealing conditions, are presented, as well as the different tests permitting one to conclude that an n-type layer was achieved in this material. Visible radiative recombination was observed when the diodes were biased in the forward direction. Details on the carrier transitions between the doping level introduced by the implantation and the valence band or the acceptor levels are presented and discussed. Author (NSA)

N71-26786 Brown Univ., Providence, R.I.
CALCULATION OF CRYSTAL FIELD SPLITTINGS OF TRIVALENT NEODYMIUM ION IN YTTRIUM ALUMINUM GARNET
Chongman Lee (Ph.D. Thesis) 1969 89 p
Avail: Univ. Microfilms Order No. 70-8748

The crystal-field calculation is done for the F-4 levels of the trivalent neodymium in yttrium aluminum garnet (YAG). Intermediate coupling wave functions for the 4f3 configuration are used to compute the operator equivalent constants for the free-ion levels of neodymium. The observed Stark splittings on the F-4 levels in YAG are used in a first-order perturbation calculation by the operator equivalent method to determine the crystal-field parameters assuming orthorhombic site symmetry at the neodymium ion. These parameters are checked on the I-4 levels, and the calculated over-all splitting is seen to be smaller than observed. This lack of agreement is believed to be due to the J-mixing effect. Dissert. Abstr.

N71-26797# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
FREQUENCY DEPENDENCE OF THE RESIDUAL RESISTANCE OF A GALVANICALLY BEGUN LEAD LAYER IN A SUPERCONDUCTING STATE MEASURED IN A TEM FIELD CONFIGURATION [FREQUENZABHAENGIGKEIT DES RESTWIDERSTANDES VON GALVANISCH AUFGEBRACHTEN BLEISCHICHTNE IN SUPRALEITENDEM ZUSTAND GEMESSEN BEI TEM-FELDKONFIGURATION]
L. Szecsi Jul. 1970 73 p refs In GERMAN; ENGLISH summary
(NP-18654) Avail: AEC Depository Libraries

The frequency dependence of the surface resistance of a superconducting lead layer in a coaxial resonator (TEM field configuration) has been investigated for the range from 0.36 to 5 GHz. The same lead layer has always been used for the various frequencies of each series of measurements. A superconducting coupling system has been developed since the losses there have to be negligible compared to those in the resonator. Moreover, the system shows the required broad band width and adjustability of the coupling factor. In agreement with the BCS theory an omega to the alpha power dependence with alpha approximately = 1.8 has been found for the superconducting fraction of the surface resistance. It was quite interesting to observe the not yet really understood residual resistance obeying approximately the same law.

It follows from the above mentioned dependence of the RF losses that lower operating frequencies are advantageous when superconducting lead resonators are used for particle accelerators or particle separators. Author (NSA)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N71-25772*# Aerojet Liquid Rocket Co., Sacramento, Calif.
INVESTIGATION OF THE SUITABILITY OF GELLED METHANE FOR USE IN A JET ENGINE Final Report, 15 Jun. 1970 – 15 Feb. 1971
E. M. Vander Wall Mar. 1971 97 p refs
(Contract NAS3-14305)
(NASA-CR-72876) Avail: NTIS CSCL 21D

The results are presented of an investigation that involved: (1) evaluation of suitable particulate gelants for liquid methane, (2) characterization of the resulting gels with respect to inhibition of nitrogen absorption, sloshing behavior, venting behavior, and effects of boil-off, and (3) heat exchanger tests to determine potential problem areas in utilizing the gels in jet engines. Both water and methanol were found to be suitable gelants for liquid methane. Liquid methane gelled with water was successfuly evaluated in the heat exchanger tests. Author

N71-26079# Naval Postgraduate School, Monterey, Calif.
AN ISOTROPIC THEORY FOR DEWETTABLE SOLIDS
G. H. Lindsey and J. E. Wood 31 Jan. 1971 72 p refs
(AD-720896; NPS-57LI71011A) Avail: NTIS CSCL 21/9

Fundamental concepts have been formulated for the mechanical behavior of isotropic, elastic materials that dewet. This has been accomplished through an examination of the stability concepts underlying the classical inviscid theory of plasticity. From a phenomenological viewpoint, the two theories differ in the nature of unloading, the dilatation behavior, the form taken by the dewetting criterion, which is analogous to the yield criterion of plasticity theory. Some restrictions to an allowable functional form of the dewetting criterion are developed, and a specific criterion compatible with these restrictions is suggested. A time-temperature superposition method is developed, using the proposed criterion coupled with reaction rate theory. Stress analysis for materials which exhibit anisotropy after dewetting is discussed, and sample problem solutions are given for quasi-elastic pressurization and slow cool-down of an encased hollow cylinder in plane strain, in which the extent of dewetting increases with time. Author (GRA)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N71-25694*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A PRELIMINARY INVESTIGATION OF CHARGE-EXCHANGE EROSION OF ACCELERATOR GRID SUPPORTS
David C. Byers Apr. 1971 16 p refs
(NASA-TM-X-67842; E-6286) Avail: NTIS CSCL 21C

A preliminary investigation was carried out to reduce or eliminate concentrated charge exchange ion erosion on the downstream grid support structures of two grid accelerator systems for electron bombardment ion thrusters. The tests indicated that the charge exchange erosion was a function of both the number of primary ion current carrying holes on the support periphery and the support diameter. In general, the depth erosion rate decreased while the erosion area and volume erosion rate increased with increasing support size. An electrically isolated support design was tested which appeared to eliminate concentrated charge exchange erosion on both the cover cap and the accelerator grid for some sample locations. Author

N71-25770*# McDonnell-Douglas Co., St. Louis, Mo. Flight Sciences Dept.
CATHODE STUDIES OF A RADIATION COOLED MPD ARC THRUSTER
J. C. Kroutil, D. W. Esker, and A. V. Sedrick May 1971 103 p refs
(Contract NAS3-13664)
(NASA-CR-72891; MDC-Q0446) Avail: NTIS CSCL 21C

There were 137 cathode-insulator modifications of the X-7 radiation cooled MPD arc thruster tested in a power range of 9.8 to 46.4 kW using ammonia as the principal propellant. Thrust performance was obtained with arc currents from 200 to 800 A, magnetic fields from 0.06 to 0.173 tesla, and mass flow rates from 4.6 to 102 mg/sec. The resulting specific impulses ranged from 472 to 11,426 sec with thrust efficiencies ranging from 4.2 to 86.7%. Specific impulse values above 10,000 sec could only be maintained for short periods, and in some cases could not be reproduced. In addition to ammonia, the following propellants were tested: argon-ammonia, nitrogen, nitrogen-hydrogen, helium, neon, and xenon. Author

N71-25808# Army Foreign Science and Technology Center, Charlottesville, Va.
PRINCIPLES OF THE THEORY OF AVIATION GAS TURBINE ENGINES [OSNOVY TEORII AVIATSIONNYKH GAZOTURBINNYKH DVIGATELEI]
I. I. Kulagin 15 Dec. 1970 307 p Transl. into ENGLISH from the Russian report
(AD-719913; FSTC-HT-23-539-71; RA-017-68) Avail: NTIS CSCL 21/5

The book reviews the principles of the theory of gas turbine engines. The main attention is devoted to the physical significance of the phenomena and behavior patterns reviewed, and especially to those questions of theory directly associated with engine operation in the aircraft, and with bench testing. Author (GRA)

N71-25910# ARO, Inc., Arnold Air Force Station, Tenn.
REQUIREMENTS FOR DIGITAL COMPUTER SIMULATION OF GAS TURBINE PROPULSION SYSTEM PERFORMANCE. PHASE 1: STEADY-STATE AND TRANSIENT ENGINE PERFORMANCE SIMULATION Final Report, 18 Jul. 1969 – 30 Jun. 1970
Lex Hutcheson, W. C. Armstrong, and C. B. Cooper AEDC Mar. 1971 37 p refs
(Contract F40600-71-C-0002)
(AD-720803; AEDC-TR-71-24) Avail: NTIS CSCL 21/5

Present and near-future requirements for the addition of digital computer simulation of gas turbine engine steady-state and transient performance to the present Engine Test Facility and Propulsion Wind Tunnel Facility digital data capability were determined based on information and guidance provided by the Air Force Aero Propulsion Laboratory and various gas turbine engine manufacturers. During Phase I of this study, digital computer high-speed core memory size and throughput times were determined and are presented for several modern steady-state and transient mathematical model simulation programs. Display requirements were also determined and are presented for full utilization of the

mathematical model results, off-line and on-line. Some preliminary results on dynamic compressor mathematical models are discussed. Author (GRA)

N71-26173* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ION BEAM DEFLECTOR Patent
Bruce A. Banks and Harold R. Kaufman, inventors (to NASA) Issued 5 Jan. 1971 3 p Filed 6 Jun. 1969 Cl. 60-202; Int. Cl. F03h5/00
(NASA-Case-LEW-10689-4; US-Patent-3,552,125; US-Patent-Appl-SN-830978) Avail: US Patent Office CSCL 21C

A deflector for electrically orienting the thrust vector of an electrostatic ion thruster having a glass-coated grid system is described. Highly negative potentials are applied to conductors that are mounted in pairs and arranged in arrays to form the grid. These electrical potentials are independently varied in each array to obtain the desired amount of ion beam vectoring. Official Gazette of the U.S. Patent Office

N71-26257# Forsvarets Forskningsanstalt, Stockholm (Sweden).
ROCKET AND JET POWER [RAKET- OCH JETDRIFT]
T. Marklund, A. Hjertstrand, and I. Bjoerk Dec. 1969 44 p In SWEDISH
(FOA-2-C-2362-1246) Avail: NTIS

Fairly intensive and continuous engine research is considered for both the conventional artillery projectile and the guided missile. The most important objectives for development are: (1) a combination of cannon firing and rocket engine to include an increase in range; (2) base bleed combining cannon firing and the production of a slow flow of gas from the base pad to reduce air resistance; and (3) ram engines with integrated solid fuel starting stage built into the ram engine's combustion chamber. After the fuel has burnt at start, the engine functions as a normal ram engine. Author

N71-26284*# Hughes Research Labs., Malibu, Calif.
THRUST VECTORING SYSTEMS. PART 1: 5 cm SYSTEMS Final Report
H. J. King, C. R. Collett, and D. E. Schnelker [1970] 98 p refs
(Contract NAS3-14058)
(NASA-CR-72677) Avail: NTIS CSCL 21C

Experimental data were taken with three different ion extraction systems (namely, the dual grid electrostatic, movable screen electrode, and vectorable discharge chamber systems), demonstrating that each is capable of vectoring the beam from a 5 cm thruster to + or − 10 degrees or more. The electrostatic system was chosen for a 100 hour endurance test over the latter two on the basis of speed of response and the absence of any moving parts. The performance of the electrostatic and movable screen systems is compared with that predicted on the basis of analytical models of each derived from a computer simulation of the ion trajectories of a single aperture. A table, comparing the merits of the various systems based on a wide range of criteria, is provided. Author

N71-26298# National Aerospace Lab., Tokyo (Japan).
GAS TURBINE COMBUSTORS
Kunio Suzuki, Takasi Tamaru, Shoji Horiuchi, and Takashi Saito Sep. 1970 82 p refs In JAPANESE; ENGLISH summary
(NAL-TR-208) Avail: NTIS

A design method for lift engines is proposed for applying recent data and experience. Various flame holders and their characteristics, the admission of air and its distributions, and flow patterns in the combustion chambers are investigated. However, on account of lack of fundamental knowledge concerning the phenomena occurring in a combustion chamber, the design details still must be dependent on the practical data and model experiments. Therefore, design data which had been experienced in many practical engines, especially those of vaporizing types, are considered. Experimental techniques necessary for developing or improving combustion systems such as temperature measurement by thermocouples, and gas analysis by means of sampling probes, are also described. Author

N71-26411*# Aerojet Liquid Rocket Co., Sacramento, Calif.
ADVANCED INJECTOR CONCEPTS INVESTIGATION Final Summary Report
30 Apr. 1971 15 p ref
(Contract NAS8-21052)
(NASA-CR-103183; Rept-21052-3FS) Avail: NTIS CSCL 21H

The results are presented of a program aimed at the exploration of a throttling injector concept applicable to an advanced cryogenic engine. An analytical investigation was made of the feasibility of tapping turbine drive gases from the combustion chamber and passing them through the injector. This effort consisted of analysis and preliminary design. It was concluded that the hot gas tapoff cycle injector concept is feasible and can operate successfully over the full throttling range specified, using nickel as the injector material. A second investigation was devoted to further exploration of the annular segment injector to gain additional data regarding combustion stability, injector face cooling, and steady-state performance at chamber pressures up to 2500 psia. The mechanical strength of the injector, designated HYPERTHIN, was demonstrated by ten tests at chamber pressures varying from 100 to 1300 psia. The injector was also subjected to numerous cold flow cycles and remained structurally sound. No face burning was evident and combustion was stable. D.L.G.

N71-26420*# United Aircraft Corp., Windsor Locks, Conn. Hamilton Standard Div.
PLANETARY EXPLORER LIQUID PROPULSION STUDY Final Report, Jul. 1970–Jan. 1971
John E. McCabe and Vincent J. Sansevero Feb. 1971 259 p
(Contract NAS5-11295)
(NASA-CR-118868; SP-07R70-F) Avail: NTIS CSCL 21H

The primary objectives of the study were to evaluate and compare a number of candidate spacecraft propulsion systems of the monopropellant hydrazine type relative to two Venus missions of an Explorer class satellite. The propulsion system of the Planetary Explorer satellite will be utilized to accomplish mid-course trajectory corrections, attitude control, spin control and orbit maneuvers of the spacecraft. The candidate systems evaluated utilized existing flight proven hardware and no new technology is required to accomplish mission objectives. A single 5 lb thrust engine was used to accomplish all required functions. Production engine test data was used in all performance analysis of the spacecraft. A computer program was generated as part of the study program to evaluate candidate system performance under simulated mission conditions. Author

N71-26428*# Rocketdyne, Canoga Park, Calif.
TITANIUM PUMP IMPELLER TESTING Final Report
J. E. Wolf 1971 45 p
(Contract NAS8-25860)
(NASA-CR-103124; TMR-0115-3141) Avail: NTIS CSCL 21E

The ceramic stresscoat, burst and pump testing of two shrouded, diffusion bonded titanium pump impellers is described. The stresscoat test showed a significant decrease in centrifugal stress in relation to a geometrically similar machined impeller. The burst test demonstrated a higher tip speed at failure than the similar machined impeller in spite of an area of poor bonding, and the liquid hydrogen performance testing demonstrated the practicality of the diffusion bonding process to fabricate shrouded titanium impellers whose hydrodynamic design is not restricted by machining methods. Author

N71-26525*# Hughes Aircraft Co., Culver City, Calif.
DEVELOPMENT AND TEST OF A FLIGHT PROTOTYPE POWER CONDITIONER FOR 20 cm MERCURY BOMBARDMENT ELECTRIC THRUSTER SYSTEM
Apr. 1971 111 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952297)
(NASA-CR-118651; SCG-10167R) Avail: NTIS CSCL 21C

A program was initiated to design and fabricate one breadboard and two experimental model power conditioners to prove the feasibility and state of the art of a lightweight, high efficiency power conditioner for use in deep space on a solar electric propelled mission. During the design and fabrication of the breadboard model, studies and analyses of reliability, weight, and efficiency were performed. The unit fabricated incorporated the study results and was fabricated as an engineering prototype unit. Prior to fabrication of the experimental systems, the thruster design was changed to incorporate a hollow cathode. The detail of modifications made to the breadboard unit is described, as is the impact on weight and reliability. Fabrication techniques to reduce weight and circuit changes from the breadboard system are also described. A summary of the reliability and efficiency analyses performed is included. The acceptance test results are tabulated and integration testing is discussed. The preliminary integration tests indicate that the experimental units operate satisfactorily with the thruster. Author

N71-28642* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ION THRUSTER ACCELERATOR SYSTEM Patent
Bruce A. Banks and Shigeo Nakanishi, inventors (to NASA) Issued 5 Jan. 1971 3 p Filed 9 Sep. 1968 Cl. 60-202; Int. Cl. F03h5/00
(NASA-Case-LEW-10106-1; US-Patent-3,552,124; US-Patent-Appl-SN-758390) Avail: US Patent Office CSCL 21C

The design and characteristics of a single grid accelerator system for ion engines are presented. Glass coated ion thruster grids which are electrically reliable replace double grid systems and produce enhanced ion extraction capability as well as enabling the use of larger diameter accelerator systems.
Official Gazette of the U.S. Patent Office

N71-26689*# Rocketdyne, Canoga Park, Calif.
INVESTIGATION OF GAS AUGMENTED INJECTORS Final Report
P. F. Mehegan, D. T. Campbell, and C. H. Scheuerman Sep. 1970 447 p refs
(Contract NAS3-12001)
(NASA-CR-72703; R-8361) Avail: NTIS HC $6.00/MF $0.95 CSCL 21H

The use of high-energy gas to enhance atomization and mixing and to generally improve gas-liquid injector concepts was investigated. Performance analyses, cold-flow experiments, and hot-firing tests were systematically conducted to produce stable operation with combustion efficiencies to 99 percent using large thrust-per-element injectors; such as, 20,000-lb (88,900 N)-thrust per element with LOX/H2 propellants and 5000-lb (22,200 N)-thrust per element with FLOX/CH4 propellants. Performance analysis, cold-flow tests, and hot-firing tests were employed to accomodate the investigation. Author

N71-28779* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METHOD OF MAKING A SOLID PROPELLANT ROCKET MOTOR Patent
Joseph G. Thibodaux, Jr., inventor (to NASA) Issued 16 Mar. 1971 5 p Filed 22 Jun. 1965 Cl. 86-1; Cl. 86-20.2; Cl. 102-101; Cl. 264-3; Int. Cl. F42b17/00; Int. Cl. F42b9/14; Int. Cl. C08b21/02 Continuation-in-part of US Patent Appl. Sn. 151110, filed 8 Nov. 1961 Substitute for abandoned US Patent Appl. SN-8200, filed 11 Feb. 1960
(NASA-Case-XLA-04126; US-Patent-3,570,364; US-Patent-Appl-SN-467820) Avail: US Patent Office CSCL 21H

A method of making a solid propellant rocket motor having reliable high-altitude capabilities, long shelf life, and capable of being fired with the use of nozzle closure is described. The motor comprises a rigid foamed plastic mandrel permanently positioned axially within the motor propellant, and electroresponsive ignition means positioned within the mandrel. Detailed descriptions accompany drawings of the device. E.M.C.

N71-28781* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROPELLANT FEED ISOLATOR Patent
Shigeo Nakanishi, inventor (to NASA) Issued 27 Apr. 1971 4 p Filed 4 Mar. 1969 Cl. 60-202; Cl. 313-63; Cl. 315-111; Int. Cl. F03h1/00; Int. Cl. F05h1/16
(NASA-Case-LEW-10210-1; US-Patent-3,576,107; US-Patent-Appl-SN-804172) Avail: US Patent Office CSCL 21C

An internal labyrinth and shield structure to improve the electrical isolation of a propellant feed source from an ion thrustor is described. A heated ceramic tube provides a duct for the propellant. Labyrinth structures within the heated tube reverse the flow direction of the propellant to increase the effective flow passage length. This increases the wall surface area to promote surface deionization of charged particles. This feed isolator will operate at pressures in the 1 torr to 10 torr range. Detailed descriptions accompany drawings of the propellant feed system and include the feed isolator. E.M.C.

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N71-25771*# Mount Auburn Research Associates, Inc., Cambridge, Mass.
THEORY OF THE EXTERNAL SHEATH STRUCTURE AND ION COLLECTION CHARACTERISTICS OF A ROCKETBORNE MASS SPECTROMETER Final Report, 2 Sep. 1969 – 30 Nov. 1970
Lee W. Parker 30 Nov. 1970 84 p refs
(Contract F19628-70-C-0053)
(AD-720833; AFCRL-71-0105) Avail: NTIS CSCL 4/1

The ion current density at the central point (orifice) of a charged mass-spectrometer plate mounted on a rocket is a function of physical parameters, including the plate voltage, the plate and rocket geometry, the Debye length, and the drift velocity of the ions relative to the plate. Computer calculations are performed to evaluate the current density for chosen values of the physical parameters. It is shown that the current density is a monotonic and linearly increasing function of the plate potential, but may behave non-monotonically with ion drift velocity. For a plate potential 200 kT/e, where T is the electron temperature, and Debye lengths larger than 1/5 the plate radius- the ion current density at unit ion Mach number is more than 100 times the random thermal current density, or more than 27.5 times larger than the value predicted by the planar approximation formula. The current-voltage characteristics and their dependence on Mach number are qualitatively similar to those for a moving sphere. The electric field enhances the current collected, for any ion Mach number. The enhancement becomes negligible only when the Mach number becomes large compared with the square root of the dimensionless plate potential. Author (GRA)

N71-25795*# Aerospace Corp., El Segundo, Calif.
SIMULTANEOUS OBSERVATIONS OF SOLAR FLARE

ELECTRON SPECTRA IN INTERPLANETARY SPACE AND WITHIN THE EARTH'S MAGNETOSPHERE Technical Report, Jan. – Dec. 1970

Alfred L. Vampola and H. I. West, Jr. 15 Feb. 1971 21 p refs Prepared in cooperation with Calif. Univ., Berkeley. Lawrence Radiation Lab.

(Contract F04701-70-C-0059)

(AD-720806; TR-0059(6260-20)-15; SAMSO-TR-71-52) Avail: NTIS CSCL 3/2

Magnetic electron spectrometers on satellites OGO-V and OV1-19 were used to make simultaneous measurements in interplanetary space and over the polar caps during the intense solar particle event of April 1969. The absolute intensities and energy spectra measured on the two satellites tracked within experimental error for the entire history of the event. The results are examined in terms of the open and closed models of the earths magnetosphere. Author (GRA)

N71-25799# Lockheed Missiles and Space Co., Palo Alto, Calif.

INVESTIGATION OF ANNIHILATION GAMMA RADIATION VARIATIONS ON THE KOSMOS-135 IN CONNECTION WITH POSSIBLE ANTIMATTER METEOR STREAMS

B. P. Konstantinov et al [1971] 10 p refs Transl. into ENGLISH from Kosm. Issled. (USSR), v. 8, no. 6, 1970 p 931–938

Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Time variations in the intensity and spectral composition of gamma radiation in near-earth space in the 0.3 to 2.7 Mev energy band were studied. The investigations were conducted in the epoch of the Geminide, Urside and Quadrantide meteor streams of the 1966 to 1967 winter in connection with a hypothesis expressed earlier anent the possible antimatter nature of comets and meteor streams. The data obtained show that periods of a significant rise in the intensity of annihilation radiation with 0.511 Mev are observed. The effect is approximately 50%. It does not touch upon the gamma radiation intensity in the remaining ranges of the spectrum investigated and the charged particle intensity. An elevated 0.511 Mev line intensity is observed during the effect of Geminide and Urside meteor streams. Connections between the observed effect and solar and geomagnetic activity are not apparently traced. Under the assumption of the validity of the hypothesis discussed, the magnitude of the effect can be explained by the quantity of antimatter introduced into earth's atmosphere per day, which equals approximately 20 mg. Author

N71-25811*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

RELATIVISTIC ELECTRONS ASSOCIATED WITH SOLAR FLARES

Kunitomo Sakurai May 1971 17 p refs Submitted for publication

(NASA-TM-X-65542; X-693-71-177) Avail: NTIS CSCL 03B

Solar flares which produce relativistic electrons generally occur within sunspot groups which are active in the emission of meter type I noise storms. It is suggested that relativistic electrons in solar flares are accelerated from the Kev-energy electrons responsible for the type I noise storms. The relationship between flare developments and the ejection of Kev-electrons is briefly considered. Author

N71-25911# Minnesota Univ., Minneapolis. Cosmic Ray Group.

THE CHEMICAL COMPOSITION AND ENERGY CONTENT OF THE ENERGETIC COSMIC RADIATION

C. J. Waddington Mar. 1971 26 p refs Presented at the Natl. Symp. on Nat. And Manmade Radiation in Space, Las Vegas, Nev., 1–5 Mar. 1971

(Contract N00014-67-A-0113-0021)

(AD-720410; CR-155) Avail: NTIS CSCL 3/2

A brief survey is made of present knowledge of the composition and energy spectra of the primary cosmic radiation. The total energy carried by all forms of cosmic radiation that have appreciable penetrability into matter has been evaluated. This information, when combined with a knowledge of the rate at which the different components deposit energy in traversing matter, would permit calculations of the radiation dose that would result from exposure to the primary cosmic radiation. It is concluded that overall these radiation effects are rather small but it is emphasized that local damage can be of much greater significance. Author (GRA)

N71-26081*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

HYDROMAGNETIC WAVES AND DISCONTINUITIES IN THE SOLAR WIND

L. F. Burlaga Mar. 1971 115 p refs Submitted for publication

(NASA-TM-X-65530; X-692-71-95) Avail: NTIS CSCL 03B

The applicability of hydromagnetic theory to the study of the microstructure of the solar wind is considered. The theory of hydromagnetic waves and discontinuities which is appropriate for the solar wind is presented along with a review of the experimental evidence for the various waves, discontinuities, and some of the instabilities which are predicted by the theory. D.L.G.

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N71-25617# Chicago Univ., Ill.

THE ASTROMETRIC PROGRAM AT YERKES OBSERVATORY Final Report, 1 Jul. 1967 – 30 Jun. 1970

William F. Van Altena 3 Mar. 1971 16 p refs Prepared in cooperation with Yerkes Observatory

(Contract N00014-67-A-0285-0004)

(AD-719932) Avail: NTIS CSCL 3/3

Astrometric research supported in part by ONR at the Yerkes Observatory during the period 1967 - 1970 is described. Topics discussed include (1) results obtained from the new parallax program, (2) proper motion and membership studies of open clusters, and (3) new instrumentation developed at the Yerkes Observatory for the astrometric programs. Author (GRA)

N71-25638# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.

PROGRAM OF THE JANUS EXPERIMENT [PROGRAMME DE L'EXPERIENCE JANUS]

M. Viton and M. Sivan 6 Jan. 1971 25 p In FRENCH

Avail: NTIS

The wide-angle camera JANUS to be used onboard balloons and satellite (D-2B) for near and far ultraviolet experiments is described as well as its technical characteristics. Some specifications related to rocket nose cones are given and operational problems discussed. ESRO

N71-25689*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

CLOSED FORM SATELLITE TRACKING DATA CORRECTIONS FOR AN ARBITRARY TROPOSPHERIC PROFILE

John W. Marini Mar. 1971 56 p refs Submitted for publication

(NASA-TM-X-65533; X-551-71-122) Avail: NTIS CSCL 22A

The formulas commonly used to correct satellite tracking data for the effects of atmospheric refraction are based, for the sake of mathematical convenience, on simple model atmospheric profiles that are not physically realistic. A method is given for deriving correction formulas that do not suffer from this limitation, and can be used in precision orbit calculations. The refractivity of

the atmosphere is assumed to have spherical symmetry, but may have any given vertical profile. The method was tested for numerical accuracy by application to the simple exponential profile, and the corrections calculated agreed closely at all elevation angles from 0 to 90 degrees with those obtained by double-precision ray-tracing. The error was in all cases less than 1%, and less than 1/3% above 1 degree elevation. Author

N71-25726# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.
COMET-LIKE INTERACTION OF VENUS WITH THE SOLAR WIND
Max Wallis Dec. 1970 24 p refs
(Rept-70-35) Avail: NTIS

Clear differences of the plasma flow past Venus from that outside the magnetosphere, in particular, absence of an upstream bow shock and of an extended ionospheric tail, characterize the Venus-solar wind interaction. Using data of the Venus probes, the interaction is interpreted from the point of view of ion creation in an extended Venusian atmosphere, similar to the outer coma of comets. The new ions both decelerate the solar wind and simultaneously gain large energies themselves. A helium upper atmosphere with standard density (10 to the 7.5 power per cu cm at 250 km) but high temperature around 1500 K would fit the observations. Heating by the solar wind via new helium ions should produce the high temperature. The total ionization rate is suitably large to support the theory of He(+) in the nightside ionosphere. Although most of the helium ions may be neutralized after transport into the lower atmosphere, the loss rate to the solar wind is still large: it should on the average equal the radiogenic production rate. Author (ESRO)

N71-25754*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SHADOW BAND PHENOMENON
John J. Quann and Christopher J. Daly May 1971 22 p refs Submitted for publication
(NASA-TM-X-65545; X-626-71-189) Avail: NTIS CSCL 03C

During the solar eclipse of March 7, 1970 data on the shadow band phenomenon were gathered at the site established at Wallops Station, Virginia, in two ways: (1) Recording onto magnetic tape of the output from six collimated photocells whose spectral responses ranged from the ultraviolet to the infrared; (2) visual and mechanical measurement of the orientation and motion of the bands. The recorded data were later processed using the output from a frequency spectrum analyzer. The majority of the energy of the shadow bands ranges between 1 and 25 hz, and appears not unlike plots of scintillation spectra. The onset, amplitude, and duration of the shadow bands seem to be spectrally related to the limb darkening of the sun's photosphere. Other results of the experiment conclusively indicate that the shadow band phenomenon is a manifestation of atmospheric turbulence in the form of air packets of different density from that of their environment (density schlieren), made visible by the light from the crescent sun. Author

N71-25774*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN ABUNDANCE ANALYSIS OF THE PHOTOMETRIC STANDARD 29 PSC
Daniel A. Klinglesmith, III May 1971 20 p refs Submitted for publication
(NASA-TM-X-65547; X-671-71-193) Avail: NTIS CSCL 03A

A fine analysis of the photometric standard star 29 Psc was performed using flux constant hydrogen-line-blanketed model atmospheres. The observable quantities, Balmer and Paschen slopes, Balmer discontinuity, and H and He I lines were used to determine the final model parameters: T sub eff = 15150 K, log g = 4.08, and N(He)/N(H) = 0.027. Lines from 14 elements besides H and He were identified, five elements (C, Mg, Si, Ti, and Fe) had a sufficient number of unblended lines with known gf values to attempt an abundance determination. Author

N71-25788# Joint Publications Research Service, Washington, D.C.
EXPEDITION OF PULKOVO ASTRONOMERS TO CHILE
M. S. Zverev 14 May 1971 54 p refs Transl. into ENGLISH from Izv. Glavnoi Astron. Observ. (Pulkovo), no. 185, 1970 p 1-31
(JPRS-53136) Avail: NTIS

A brief account of the history of the Pulkovo astronomers' expedition to Chile is given and progress of five years of work (1962-1968) is described. The following astronometric problems were investigated: (1) absolute determination of the coordinates of bright and faint fundamental stars for an improvement of the system of celestial coordinates, (2) differential meridian observations of reference faint stars and bright stars in the zones to the south of -25 deg, and (3) photographic observations of selected minor planets and areas with galaxies to compile a catalog of faint stars. The number of clear nights in use (average of 230 during year) and number of meridian observations are given in tables. Tables also show results of meridian observations of fundamental star series. Author

N71-25796*# Texas Univ., Dallas.
LUNAR ATMOSPHERE
Francis S. Johnson [1971] 32 p refs Submitted for publication
(Grant NGL-44-004-001)
(NASA-CR-118830; SP-71-001) Avail: NTIS CSCL 03C

A rarified atmosphere on the moon is reportedly due to contributions from the solar wind, meteoric volatilization, and internal degassing. Transient contributions to the atmosphere must be produced by rocket gases during lunar missions. These gases may obscure the ambient atmosphere in the vicinity of the landing site for a period of several months following a lunar landing. Of the three natural sources, definite predictions can only be made on the basis of solar wind input. The lunar atmosphere of solar origin is expected to consist mainly of neon, lighter gases being less prevalent because of their lesser concentrations in the solar wind. Daytime neon concentrations are expected near 6 x 10,000 minus cu cm, and nighttime concentrations near 1.5 x 1 million minus cu cm. Author

N71-25800*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMPI SPACECRAFT INITIAL MAGNETIC TEST
William L. Eichhorn Oct. 1970 14 p
(NASA-TM-X-65526; X-325-70-472) Avail: NTIS CSCL 22B

The IMP-I spacecraft's initial magnetic test consisted of dc rotation deperming on two axes. This procedure reduced the perm bias at the location of the flight sensor to within the specified limits (< or = to 0.125 nanoteslas on each axis) and reduced the permanent magnetic moment of the spacecraft from 376 to 55 mA-m sq. The flight magnetometer was successfully calibrated on all ranges. Author

N71-25804*# Translation Consultants, Ltd., Arlington, Va.
ON THE THEORY OF PHYSICAL INTERACTION AND STABILITY
G. Spaeth Washington NASA May 1971 36 p Transl. into ENGLISH from the book "Zur Theorie der Physikalischen Wechselwirking und Stabilitaet" (W. Germany), Schlangenbad/Taunus, Dec. 1969 p 1-38
(Contract NASw-2038)
(NASA-TT-F-13489) Avail: NTIS CSCL 03B

Some ideas on the theory of physical interaction and stability,

using interaction in the planetary system as an example, are advanced and some consequences in physics are presented. Author

N71-25806# Arizona Univ., Tucson.
A GROUNDBASED INFRARED SKY SURVEY Annual Technical Report
Frank J. Low 30 Sep. 1970 22 p refs
(Contract F19628-70-C-0046; ARPA Order 1386)
(AD-720845; AFCRL-71-0081) Avail: NTIS CSCL 3/2

The design, construction, operation and performance of a survey of the sky at infrared wavelengths is reported. A preliminary survey at 5 microns was conducted. This was followed by the more elaborate system using 8 detectors at 11 microns. Information concerning absolute calibration and performance is given. Author (GRA)

N71-25814*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING AND DATA SYSTEM SUPPORT FOR THE PIONEER PROJECT. VOLUME 6: PIONEER 7, EXTENDED MISSION, 24 FEBRUARY 1967 – 1 JULY 1968
N. A. Renzetti 15 Apr. 1971 162 p refs
(Contract NAS7-100)
(NASA-CR-118339; JPL-TM-33-426-Vol-6) Avail: NTIS CSCL 22A

The Tracking and Data System supported the deep space phase of the Pioneer 7 mission, which is in an outward trajectory from the earth in a heliocentric orbit. During the period of this report, six scientific instruments aboard the spacecraft continued to register information relative to interplanetary particles and fields, and radio metric data generated by the network continues to improve knowledge of the celestial mechanics of the solar system. In addition to detail network support activities, network performance and special support activities are covered. Author

N71-25815*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING AND DATA SYSTEM SUPPORT FOR THE PIONEER PROJECT, VOLUME 7. PIONEER 7: EXTENDED MISSION, 1 JULY 1968 – 1 JULY 1969
N. A. Renzetti 15 Apr. 1971 195 p refs
(Contract NAS7-100)
(NASA-CR-117961; JPL-TM-33-426-Vol-7) Avail: NTIS CSCL 22A

The Pioneer 7 mission (outward trajectory, heliocentric orbit) utilized six scientific instruments to accumulate information relative to interplanetary high-energy particles, solar phenomena, and plasma. The spacecraft also served as a celestial mechanics experiment reference point. The Tracking and Data System (comprising the Air Force Eastern Test Range, Deep Space Network, Manned Space Flight Network, and NASA Communications Network) tracked the spacecraft from launch through near earth and deep space phases. For near earth communications and tracking, all Tracking and Data System facilities responded to mission, launch vehicle, and range requirements. For deep space communications, and tracking, the Deep Space Network responded to tracking, telemetry, command, monitoring, simulation, and operations control requirements. Author

N71-25923# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METEOR RADIO ELECTRONICS
E. I. Fyalko 3 Dec. 1970 30 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Radioelektronika (USSR), v. 12, no. 5, 1969 p 445–460
(AD-720372; FTD-HC-23-396-70) Avail: NTIS CSCL 4/1

A definition of meteor radio electronics is given. Its constituent parts are described. A short essay on the history of the formation of meteor radio electronics is given. The main periods of its development are described. The main problems and tasks confronting modern meteor radio electronics are enumerated. Brief information on meteors is presented. Author (GRA)

N71-25924# Lockheed Missiles and Space Co., Palo Alto, Calif.
RENDEZVOUS IN ORBIT
V. Anuchin [1971] 6 p Transl. into ENGLISH from Aviats. i Kosmonavt. (Moscow), no. 2, 1971 p 30–31
Avail: NTIS; National Translation Center, John Crerar Library, Chicago, Ill. 60616

The fundamental methods of orbital rendezvous are outlined including direct earth launching and orbital launching with transfer maneuvers. Long range and short range homing maneuvers are discussed for rendezvous with space stations in circular orbit. J.M.

N71-25948*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
MULTICOLOR PHOTOMETRY OF SUPERGIANTS AND CEPHEIDS
Thomas Kelsall (Ph.D. Thesis – Maryland Univ.) May 1971 235 p refs Submitted for publication
(NASA-TM-X-65543; X-641-71-184) Avail: NTIS CSCL 03A

The results of photometry of supergiants and cepheids in a seven filter system are presented. A color index was used in combination with other colors to produce four indices freed from the effects of interstellar reddening. The four indices gave measures of the Balmer discontinuity, effects of the metallic line absorption in the violet region of the spectra, break in the spectrum across the G-band, and the strength of the cyanogen band head at 4216A. The separation of supergiants from stars of other luminosity classes was performed by a nonlinear mapping of the colors onto an M sub v, log T sub e H-R diagram. The Balmer discontinuity index for supergiants and cepheids was insensitive to the effects of line blanketing. We speculate that this will allow for a precise calibration in terms of gravity. The strengths of the metallic line absorption and CN absorption were strongly correlated. No obvious correlation was found between galactic position and chemical composition, as indicated from the strength of the metallic line index. Author

N71-25951# Joint Publications Research Service, Washington, D.C.
ORIENTATION AND FUNDAMENTAL CATALOG SYSTEMS FROM OBSERVATIONS OF MAJOR AND MINOR PLANETS
D. P. Duma 12 May 1971 46 p refs Transl. into ENGLISH from Fiz. Solntsa Zvezd (Kiev), no. 7, 6 Aug. 1969 p 3–39
(JPRS-53109) Avail: NTIS CSCL 03B

Conditional equations are derived for determining the fundamental catalog zero points from observation of major and minor planets. Conditions under which corrections to equinox and equator could be separated from corrections to the elements of the planet's and Earth's orbits are discussed. The conclusion is that determination of the correction of catalog zero points from observation of minor planets loses its advantage because of the complex correlations between the coefficients of the equations. Utilization of the stationary artificial Earth's satellites is suggested as a possible method for solving the problem. Author

N71-25962*# Bellcomm, Inc., Washington, D.C.
AN ANALYTICAL MODEL OF ECLIPSING BINARY STAR SYSTEMS
D. B. Wood 16 Apr. 1971 56 p refs
(Contract NASw-417)
(NASA-CR-118643; TM-71-1011-4) Avail: NTIS CSCL 03A

An approach to the modeling of eclipsing binary star systems is described. The model described takes advantage of a digital computer and thus allows a reduction in the number of simplifying

assumptions. The validity of this model is tested through analysis of numerical integration errors, comparison with the spherical model, parametric studies, and application to observational data. It is concluded that the application to model is a valid representation of eclipsing systems, and that it is a useful tool for the analysis of such systems. Author

N71-25865*# Electro-Optical Systems, Inc., Pasadena, Calif.
REFLECTOMETER EXPERIMENT FOR APPLICATION TECHNOLOGY SATELLITE, PHASE 2 Final Report
1 Jan. 1971 185 p refs
(Contract NAS5-9869)
(NASA-CR-118632; Rept-7003-Final) Avail: NTIS CSCL 22A

The reflectometer instrument, the measurement techniques involved in determining the sample degradation, and reduced flight data obtained during the period of operation are described. Reflective surface degradation data gathered from 18 test samples flown on the Applications Technology Satellite (ATS-3) are presented. The reflectometer instrument measured specular sample reflectivity in four spectral bands plus one broadband. The measurements covered a spectral range of 0.3 to 3 microns. The primary objective of this instrument was to test, in actual space environment, the durability of selected specularly reflective surface materials in order to obtain directly applicable data for use in equipment design. A secondary aim of the experiment was to obtain data of scientific value relating to the degradation process. Author

N71-26036*+ National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PERFORMANCE VERIFICATION TRAJECTORIES FOR THE McDONNELL-DOUGLAS HIGH CROSS-RANGE SHUTTLE CONFIGURATION
Orval E. Etheridge 12 May 1971 122 p ref
(NASA-TM-X-64596) Avail: NTIS CSCL 22C

The results of performance verification trajectories are presented based on a high cross-range two-stage reuseable shuttle configuration for three missions as follows: (1) a 92.6 × 185.2 km orbit with an inclination of 55 degrees launched from the eastern test range, (2) a 92.6 × 185.2 km orbit with an inclination of 28.5 degrees launched from the eastern test range, and (3) a 92.6 × 185.2 km orbit with an inclination of 90 degrees launched from the western test range. Author

N71-26089*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A DIFFERENTIAL CORRECTION TECHNIQUE FOR DETERMINING PHYSICAL PROPERTIES OF THE MARTIAN ATMOSPHERE BY USE OF SOLAR OCCULTATION AS SEEN FROM AN ARTIFICIAL SATELLITE
James R. Williams and H. Andrew Wallio Washington May 1971 71 p refs
(NASA-TN-D-6258; L-7601) Avail: NTIS CSCL 03C

A least-squares differential correction technique was developed to determine the physical properties of the Martian atmosphere by use of solar occultation data. The surface pressure, surface temperature, and temperature lapse rate in the atmosphere can best be determined, for a wide range of initial estimates of the parameter values, by observing a wavelength of about 5500 A. This wavelength appears to provide the best and the most rapid convergence in the curve-fitting process for the three atmospheric parameters that were used in the analysis. Author

N71-26107# National Oceanic and Atmospheric Administration, Washington, D.C. National Environmental Satellite Service.
SATELLITE ACTIVITIES OF NOAA 1970
Mar. 1971 15 p ref
Avail: Issuing Activity

The satellite activities of the various sections of the National Oceanic and Atmospheric Administration are reported. Included are the studies of: the National Weather Service, National Marine Fisheries Service, Environmental Research Laboratories, National Ocean Survey, and National Environmental Satellite Service. F.O.S.

N71-26144*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO 11 LUNAR SURFACE OPERATIONS PLAN Final Report
William H. Wood, Jr. 27 Jun. 1969 190 p refs
(NASA-TM-X-67180) Avail: NTIS CSCL 22C

Equipment requirements, crew/equipment interfaces, and final flight planning and crew activities for lunar surface EVA operations during the first manned lunar landing mission are defined. The plan delineates how the lunar surface operational and scientific objectives for the first manned lunar landing mission is to be accomplished through premission timelining and procedures definition. The nominal plan is for a single two-man lunar excursion. The planned duration is to be two hours and forty minutes or upon reaching a predetermined red line on one of the portable life support system consumables. In addition to the nominal timeline, the plan presents three other timelines for the lunar EVA. The major difference in the alternate timeline, from the nominal, is the addition of the S-band erectable antenna deployment which reduces the time available for the documented sample collection. The first contingent timeline, contingent EVA 1, is a presentation of activities for a minimum-time, one-man EVA. The second contingent timeline, contingent EVA 2, is for a one-man, two-hour EVA. Author

N71-26152# Research Inst. of National Defence, Stockholm (Sweden).
SATELLITE AND SPACE TECHNOLOGY [SATELLITER OCH RYMDTEKNIK]
C. Haglund and A. Hjertstrand Nov. 1969 53 p refs In SWEDISH
(FOA-2-C-2357-12) Avail: NTIS

Developments in satellite and space technology are considered. A presentation of the historical background is given and a number of fundamental factors such as different types of orbits, firing pads and defense against satellites are described. Then follows the present position concerning the use of satellites, i.e. those that have significance in our daily lives, both civil and military. Finally, a forecast for development up to the end of 1980 is included. Author

N71-26209*# Arizona Univ., Tucson.
COMMUNICATIONS OF THE LUNAR AND PLANETARY LABORATORY, COMMUNICATIONS NOS. 153-169, VOLUME 8, PART 6
Gerard P. Kuiper, ed. 1970 70 p refs Supported by NASA and NSF
(Grant NGL-03-002-002)
(NASA-CR-118504) Avail: NTIS CSCL 03A

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3. THE ORBIT OF COMET 1941c-1941IV (DE KOCK-PARASKEVOPOULOS) G. Van Biesbroeck p 333-335 refs (See N71-26212 14-30)

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7. DAYTIME H2O MEASURES ON MOUNTAIN SITES L. Randic and G. P. Kuiper p 391–395 refs (See N71-26216 14-30)

8. CALIBRATION OF LOW H2O METER D. P. Cruikshank and A. B. Thomson p 397–398 refs (See N71-26217 14-14)

N71-26210*# Arizona Univ., Tucson.
DEFINITIVE ORBIT OF COMET 1940d-1940IV (WHIPPLE-PARASKEVOPOULOS)
G. Van Biesbroeck *In its* Commun. of the Lunar and Planetary Lab., Commun. Nos. 153–159, Vol. 8, Pt. 5 1970 p 329–330 refs *Its* Commun. No. 153 (See N71-26209 14-30)
(Grant NSF GP-17784)
Avail: NTIS CSCL 03A

The orbit for Comet 1940d-1940IV was calculated using all available data with double weight given to the later accurate measures. The orbit is elliptical with a period of 432 years. Author

N71-26211*# Arizona Univ., Tucson.
THE ORBIT OF COMET NEWMAN 1932f-1932VII
G. Van Biesbroeck *In its* Commun. of the Lunar and Planetary Lab., Commun. Nos. 153–159, Vol. 8, Pt. 5 1970 p 331–332 refs *Its* Commun. No. 154 (See N71-26209 14-30)
(Grant NSF GP-17784)
Avail: NTIS CSCL 03B

Using 82 observations covering an interval of 213 days, a definitive orbit is obtained, taking planetary perturbations into account. The orbit comes out very nearly parabolic. Author

N71-26212*# Arizona Univ., Tucson.
THE ORBIT OF COMET 1941c-1941IV (DE KOCK-PARASKEVOPOULOS)
G. Van Biesbroeck *In its* Commun. of the Lunar and Planetary Lab., Commun. Nos. 153–159, Vol. 8, Pt. 5 1970 p 333–335 refs *Its* Commun. No. 155 (See N71-26209 14-30)
(Grant NSF GP-8059)
Avail: NTIS CSCL 03B

The 156 observations of Comet 1941c, covering an interval of 268 days, have been grouped in 7 normal places. The differential correction led to an elliptic orbit with an eccentricity of 0.9999574. Both the original and the future values of the reciprocal semi-major axis remain positive. Author

N71-26213*# Arizona Univ., Tucson.
HIGH ALTITUDE SITES AND IR ASTRONOMY, 2
Gerard P. Kuiper *In its* Commun. of the Lunar and Planetary Lab., Commun. Nos. 153–159, Vol. 8, Pt. 5 1970 p 337–374 refs Revised *Its* Commun. No. 156 (See N71-26209 14-30)
(Grant NGL-03-002-002)
Avail: NTIS CSCL 03A

High altitude sites suitable for IR astronomy are discussed for Polar, Sub-Polar, and mid-latitudes of both hemispheres. The climatology, accessability, and facilities of existing stations are described with some desirable locations for additional sites. High altitude acclimatization for personnel is also discussed. F.O.S.

N71-26216*# Arizona Univ., Tucson.
DAYTIME H2O MEASURES ON MOUNTAIN SITES
L. Randic and G. P. Kuiper *In its* Commun. of the Lunar and Planetary Lab., Commun. Nos. 153–159, Vol. 8, Pt. 5 1970 p 391–395 refs *Its* Commun. No. 158 (See N71-26209 14-30)
Avail: NTIS CSCL 03A

Measurements of the precipitable water-vapor content of the overlying atmosphere for selected stations in the Southwest. The amounts are expressed in millimeters, reduced to a pressure of one atm. Differential temperature effects are neglected. The measures are based on the 0.935 micron absorption band. Author

N71-26290*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HOW TO USE MAGNETIC FIELDS FOR FUN AND PROFIT
C. P. Sonett and S. K. Runcorn (Univ. of Newcastle, England) May 1971 11 p refs
(NASA-TM-X-62023) Avail: NTIS CSCL 03C

A discussion is presented centered around the question of the origin and the subsequent evolution of the moon. The primary question considered is how the remanent magnetism observed in the Apollo samples originated. Theories are advanced aimed at answering this question and at the same time providing a better understanding of other manifestations of lunar magnetism obtained by the Explorer 35 lunar orbiter, the Apollo 12 lunar surface magnetometer, and the Apollo 14 lunar portable magnetometer. D.L.G.

N71-26321*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DATA CATALOG OF SATELLITE EXPERIMENTS (NSSDC 69-01), SUPPLEMENT
Oct. 1970 96 p
(NASA-TM-X-67181; NSSDC-70-12-Supp) Avail: NTIS CSCL 22A

This supplement to the Data Catalog of Satellite Experiments last published in January 1969, has been redesigned to reflect the contents of the computerized National Space Science Data Center (NSSDC) information system. This system provides an efficient method for announcing the availability of data when processing is complete and for announcing the acquisition of new data. A cumulative edition of the catalog will be issued at a later date. The feasibility of a Selective Dissemination of Information (SDI) system is currently being investigated. The SDI system would enable the data center to notify interested individuals of data sets or experiments in a particular scientific discipline as soon as they become available for distribution. Author

N71-26322# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ORBIT AVERAGED VARIATION OF EARTH SATELLITE ORBITAL ELEMENTS
Michael E. Ash 22 Feb. 1971 35 p refs
(Contract F19628-70-C-0230)
(AD-720823; TN-1971-6; ESD-TR-71-18) Avail: NTIS CSCL 22/3

An orbit averaging numerical integration method for determining the variation in the shape and orientation of an earth satellite orbit is discussed. Author (GRA)

N71-26361 Kentucky Univ., Lexington.
THE DETERMINATION OF ZIRCONIUM AND HAFNIUM IN METEORITES AND TERRESTRIAL MATERIALS BY ACTIVATION ANALYSIS
Teofila Velasco Rebagay (Ph.D. Thesis) 1969 185 p
Avail: Univ. Microfilms Order No. 70-12370

A sensitive analytical technique to measure the zirconium and hafnium concentrations simultaneously in the same specimen was developed to establish abundance distribution patterns of these elements in natural materials. The procedure involved a radio chemical separation of zirconium and hafnium following neutron

irradiation of the specimens. A preliminary separation of zirconium and hafnium from the bulk materials which required no individual separation of these elements from each other was achieved through ion exchange on a strongly basic anion exchange resin. An automated fast neutron activation analysis system was employed for the rapid and nondestructive determination of the chemical yield of the zirconium oxide. The chemical yield determined this way were in good agreement with those found using spectrophotometric methods. The geochemistry of zirconium, and hafnium, as well as possible causes for the variation of the Zr/Hf during the formation of the earth's crust, are also treated. Dissert. Abstr.

N71-26400*# Columbia Univ., New York. Astrophysics Lab.
ASTRONOMICAL X-RAY POLARIMETRY PROGRAM-DEFINITION PHASE STUDY Final Report
R Novick Mar. 1971 129 p refs
(Contract NAS8-24668)
(NASA-CR-103125) Avail: NTIS CSCL 03A

The use of mosaic crystals for celestial X-ray polarimetry and spectroscopy and their application in a large orbiting X-ray observatory are described. The following conclusions were drawn: (1) Certain crystalline materials such as graphite, lithium hydride, and tungsten disulfide in their mosaic form are ideally suited for significant celestial X-ray polarimetry. (2) These crystals, particularly lithium hydride, when coupled with an X-ray telescope to form an objective crystal spectrometer, result in a device that combines the highest possible spectral resolution with the highest possible efficiency of a scanning spectrometer. (3) The crystals can be usefully employed in a slitless spectrometer in those situations where the time of observation per resolution element is limited. A highly efficient flight prototype of a graphite crystal polarimeter to be used in the focal plane of a grazing-incidence X-ray telescope, two large-area graphite crystal spectrometers, a laboratory objective crystal spectrometer employing graphite crystals, and four large-area focusing graphite polarimeters were developed. A process for producing large areas of tungsten disulfide in mosaic form is described. Author

N71-26441*# Bellcomm, Inc., Washington, D.C.
THE LUNAR MICROMETEOROID EXPERIMENT, L033
J. S. Dohnanyi 20 Apr. 1971 31 p refs
(Contract NASw-417)
(NASA-CR-118663; TM-71-2015-2) Avail: NTIS CSCL 03C

Use of the Pioneer 7 and 8 cosmic dust detectors in the lunar ejecta and micrometeorites (LEAM) experiment is discussed. All sensors of the LEAM experiment should record secondaries at rates that exceed the detection rate of primaries by one or two orders of magnitude. This follows from the sensitivity of the sensors to the energy and momentum distribution of primary micrometeorids and secondary lunar ejecta, as well as to the angular distribution of ejecta. The great majority of secondaries will impact the sensors on the descending portion of their trajectories. The contribution of meteor showers is expected to be small. These general conclusions follow from a LEAM performance analysis that is based on a model for the distribution of secondary ejecta and on estimates of primary and secondary impact rates. The present results provide a method for deriving the mass, velocity, and angular distribution from experimental impact data. Author

N71-26442*# Rensselaer Polytechnic Inst., Troy, N.Y.
PRELIMINARY DESIGN OF AN AUTOMATIC DEVICE FOR THE LOCATION OF THE POLE STAR AND/OR TRUE POLE OF MARS
David J. Rieback May 1971 41 p refs
(Grant NGL-33-018-091)
(NASA-CR-118655; RPI-TR-MP-20) Avail: NTIS CSCL 03A

An automatic system is designed for an unmanned surface vehicle to locate the pole star of Mars and to supply this information to the navigational equipment. The automatic system operates on the concept that if a unique group of stars can be found in the heavens, a geometrical relationship can be derived from this group that allows the generation of the location of the pole star. This is accomplished through the use of a pattern recognition system. The system designed in this project operates on this principle and will locate the pole star and/or any point in the heavens desired. The pole star location generated by the system is more than accurate enough for most navigational needs. Author

N71-26443 California Inst. of Tech., Pasadena.
DIFFUSION PROCESSES IN A-PEC STARS. 1. NUCLEOSYNTHESIS IN Si BURNING. 2
Georges J. Michaud (Ph.D. Thesis) 1969 212 p
Avail: Univ. Microfilms Order No. 70-12491

Diffusion processes were found to lead to most of the peculiar abundances observed in A-pec stars. If it is assumed that the atmosphere is stable enough for diffusion processes to be important, gravitational settling leads to the underabundances of He, Ne, and O in the stars where they are observed. Radiation pressure leads to the overabundances of Mn, Sr, Y, Zr, and the rare earths in the stars where they are observed. The magnetic fields observed in A-pec stars could bring to the atmosphere the stability needed for diffusion processes to be important. The conditions necessary to generate through nuclear reactions, the abundances observed between Si-28 and Co-59 were also studied. It was found that most of the observed abundances could have been generated in a single process, Si burning. The density was found to have no effect on our results. The temperature is more important but the range of freezing temperatures to be expected can be estimated accurately enough from the dynamic time scale. Dissert. Abstr.

N71-26452# Joint Publications Research Service, Washington, D.C.
VESTNIK OF THE USSR ACADEMY OF SCIENCES, VOLUME 40, NO. 6, 1970
M. D. Millionshchikov, ed. 31 Aug. 1970 188 p refs Transl. into ENGLISH from Vestn. Akad. Nauk SSSR (Moscow), v. 40, no. 6, 1970 p 3-134
(JPRS-51284) Avail: NTIS

CONTENTS:

1. THE APPLICATION OF LASERS FOR THERMONUCLEAR SYNTHESIS N. G. Basov p 64-75 ref (See N71-26453 14-16)
2. SOME METHODOLOGICAL ASPECTS OF CHEMICAL KINETICS N. M. Emanuel p 76-92 refs (See N71-26454 14-06)
3. PROCESSES OF LUMINESCENCE IN SOLIDS S. Z. Roginskiy et al p 93-102 refs (See N7126455 14-26)
4. THE SOIL SCIENCES AND THE PRODUCTIVITY OF THE BIOSPHERE V. A. Kovda p 103-112 ref (See N71-26456 14-04)
5. CHANGES OF THE NATURE OF THE EARTH'S SURFACE IN THE LATEST GEOLOGICAL EPOCH K. K. Markov p 113-121 (See N71-26457 14-13)
6. WORK ON MAGNETOHYDRODYNAMICS (SYMPOSIUM IN THE USA) V. V. Prokudin p 127-132 refs (See N71-26458 14-25)
7. PROBLEMS OF TROPICAL WEATHERING (SYMPOSIUM IN INDONESIA) V. M. Fridland p 133-137 refs (See N71-26459 14-13)
8. PROBLEMS OF PROGRAMMING (ALL-UNION CONFERENCE IN NOVOSIBIRSK) A. P. Yershov p 142-145 refs (See N71-26460 14-08)
9. STUDY OF THE SUBJECTIVE ESTIMATION OF IMAGE QUALITY (ALL-UNION SYMPOSIUM IN MOSCOW) S. M. Kozlovskiy p 146-148 refs (See N71-26461 14-14)
10. THE MECHANISM AND KINETICS OF HETEROGENEOUS

REACTIONS (SYMPOSIUM IN MOSCOW) V. A. Seleznev et al p 149–153 refs (See N71-26462 14-06)

11. URGENT PROBLEMS OF CHEMICAL KINETICS (CONFERENCE IN MOSCOW) V. N. Kondratyev p 154–156 refs (See N71-26463 14-06)

The book is devoted to the flight dynamics of a rocket in its powered phase. Particular attention is devoted to an examination of analytical methods of obtaining the characteristics of the motion of the center of mass of an airborne vehicle. GRA

N71-26536 California Inst. of Tech., Pasadena.

STATIC AND DYNAMICAL MODELS OF LONG PERIOD VARIABLE STARS

Douglas Allan Keeley (Ph.D. Thesis) 1970 153 p

Avail: Univ. Microfilms. Order No. 70-12438

The equation of state included a detailed calculation of ionization equilibrium and the dissociation of H2, OH, CO, and H2O. The opacity of CO, OH, and H2O was included. The dynamic calculations show that large -amplitude pulsation can occur in convective models. The opacity mechanism causes strong driving of the pulsation in the region outside the hydrogen ionization zone, and the gamma-mechanism results in very low dissipation in the hydrogen zone. The phase relation between the bolometric luminosity and the radius variations is similar to that of Cepheids. The static models have large ionization and dissociation zones, which cause the pulsation parameter to become greater than 0.15 in some models. The fundamental periods ranged from 180 days to greater than 2000 days; the overtone periods are about 1/3 as long. The positions of many observed stars in the theoretical HR diagram suggest that their periods should be associated with the overtone periods of the models. Dissert. Abstr.

N71-26606# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ROCKET FLIGHT THEORY [K TEORII POLETA RAKET]

L. M. Vorobev 19 Jan. 1971 262 p refs Transl. into ENGLISH from the Russian

(AD-720739; FTD-HT-23-875-70) Avail: NTIS CSCL 19/4

The book is devoted to the flight dynamics of a rocket in its powered phase. Particular attention is devoted to an examination of analytical methods of obtaining the characteristics of the motion of the center of mass of an airborne vehicle. GRA

N71-26610*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Mission Analysis Div.

MATHEMATICAL FORMULATION OF THE DOUBLE PRECISION ORBIT DETERMINATION PROGRAM (DPODP)

Theodore D. Moyer 15 May 1971 170 p refs

(Contract NAS7-100)

(NASA-CR-118673; JPL-TR-32-1527) Avail: NTIS CSCL 22A

The complete mathematical model is documented for the Double-Precision Orbit Determination Program (DPODP), a third-generation program which has recently been completed at the Jet Propulsion Laboratory. The DPODP processes earth-based Doppler, range, and angular observables of the spacecraft to determine values of the parameters that specify the spacecraft trajectory for lunar and planetary missions. The program was developed from 1964 to 1968; it was first used operationally for the Mariner 6 and 7 spacecraft which encountered Mars in August of 1969. The DPODP has more accurate mathematical models, a significant increase in numerical precision, and more flexibility than the second-generation Single-Precision Orbit Determination Program (SPODP). Doppler and range observables are computed to accuracies of 0.00001 m/s and 0.1 m, respectively, exclusive of errors in the tropospheric, ionospheric, and space plasma corrections. Author

N71-26650*# Geological Survey, Menlo Park, Calif.

BEARING CAPACITY OF LUNAR SURFACE MATERIALS

Glen L. Martin *In its* Geol. Surv. Res. 1970, Chapter D 1970 p D233–D237 refs (See N71-26644 14-13)

(NASA Order R-09-020-001)

(NASA-CR-118505) Avail: NTIS; SOD $3.75 CSCL 03C

Slope stability analysis, applied to failed slopes in lunar craters, suggests that the static mass-bearing capacity of the lunar surface may range from 860 to as much as 9,400 g/sq cm. The analysis includes seismic acceleration as one of the variables. Such accelerations may have a pronounced effect on the stability of lunar slopes. Author

N71-26679# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.

A HIGH DISPERSION SPECTRAL ANALYSIS OF THE BA II STAR HD 204075 (ZETA CAPRICORNI)

Jack L. Tech Mar. 1971 177 p refs

(NBS-MONOGRAPH-119) Avail: SOD $3.25

A double differential curve of growth analysis, using both the sun and epsilon Virginis (G9 II-III) as comparison stars, has been performed for the Ba II star zeta Capricorni. The observational material consists of equivalent widths, central depths, and half-widths for 1100 spectral lines measured on direct-intensity tracings of plates. Line identifications given in earlier lists for barium stars have been critically re-examined. Three lines have been attributed with reasonable certainty to dysprosium, which has not previously been observed in barium stars. Atmospheric abundances have been derived for 37 elements. The results obtained with respect to the two comparison stars are in good agreement. The barium star exhibits essentially solar abundances for most elements lighter than germanium, but overabundances by factors of about two are indicated for carbon and lithium. Overabundances by factors of about eight or nine have been found for the s-processed rare earths, as well as for dysprosium, which is generally considered to be r-processed. Author

N71-26690*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

APPROXIMATE TRAJECTORY DATA FOR MISSIONS TO THE MAJOR PLANETS

Laurence H. Fishbach, Lawrence L. Giventer, and Edward A. Willis, Jr. Washington Mar. 1971 215 p refs Previously announced as N71-20502

(NASA-TN-D-6141; E-5892) Avail: NTIS CSCL 22A

Trajectory data for missions to Jupiter, Saturn, Uranus, and Neptune and their moons are presented in the form of contour charts and tables. They are useful for determining preliminary mission Delta V requirements and also identifying areas of interest for advanced propulsion concepts. Data for both one-way and round-trip trajectories are shown for flyby and orbiter (circular and elliptical) missions. A class of round-trip trajectories using elliptical parking orbits and having a minimum Delta V at approximately one-half of Hohmann time is found. Since the trajectory model used circular-coplanar planet orbits, the results apply approximately to any launch date. Author

N71-26712*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

TRACKING AND DATA SYSTEM SUPPORT FOR THE MARINER MARS 1969 MISSION. VOLUME 1: PLANNING PHASE THROUGH MIDCOURSE MANEUVER

N. A. Renzetti, K. W. Linnes, D. L. Gordon, and T. M. Taylor 15 May 1971 238 p refs

(Contract NAS7-100)

(NASA-CR-118520; JPL-TM-33-474-Vol-1) Avail: NTIS CSCL 22A

The requirements for tracking, telemetry, command, simulation, mission control, and compatibility testing were reviewed for matching to DSN capabilities. Unusual new features of the DSN system were the multimission telemetry system, which eliminated

need for mission-dependent equipment at the tracking stations, and an experimental high rate telemetry system operating at 16,200 bits/sec. This high rate permitted return of low resolution pictures in real time, and full resolution pictures played back from the spacecraft tape recorder in less than 3 hr. Flight support was provided in the near-earth phase by the ETR and the MSFN Ascension Island station. The DSN 26-m antenna stations provided deep space phase support. During the cruise portion of the deep space phase, the DSN 64-m antenna at Goldstone, Calif., provided ranging data to planetary distances; during the planetary encounter, it provided the 16,200 bits sec capability by means of the block-coded, high-rate telemetry system. Virtually all tracking and telemetry data received on earth was acquired, processed, and delivered to the project. All commands delivered to the DSN by the project for transmission to the spacecraft were transmitted successfully. Author

N71-28788# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

SAINT-SEVERIN METEORITE: CALCULATION OF THE ATMOSPHERIC TRAJECTORY AND ORBIT [LA METEORITE SAINT-SEVERIN: RECHERCHE DE LA TRAJECTOIRE ATMOSPHERIQUE ET DE L'ORBITE]

Daniel Nordemann, Jacques Tobailem, Charles Henri de Lesseux St-Genies Nov. 1970 13 p refs In FRENCH
(CEA-R-4045) Avail: AEC Depository Libraries

Meteoric fragments found in the vicinity of Saint-Severin are used to reconstruct the probable meteor orbit in the solar system and its atmospheric trajectory before breakup. Considered are the geographical coordinates of the distribution points of fragment impacts, the original meteor shape before breakup as determined by mass calculation from fragment weights, and the fragmentary mass as function of distance from the impact. Computer calculations are performed in FORTRAN. Transl. by G.G.

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N71-25611*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A CONCEPTUAL STUDY OF A MOMENTUM WHEEL STABILIZED GEOSTATIONARY AERONAUTICAL SATELLITE

W. N. Redisch, A. F. White, and G. Goldberg Jan. 1971 130 p
(NASA-TM-X-65509; X-490-71-78) Avail: NTIS CSCL 22B

The conceptual design and analysis of a synchronous equatorial satellite utilized for an experimental/preoperational aeronautical satellite system (NETCOS) is presented. The concept studied is a momentum wheel stabilized, sun-oriented satellite, with a North Atlantic pointing antenna. The 1200 watt satellite is launched on the Delta launch vehicle and utilizes an apogee engine to achieve synchronous equatorial orbit. The study guidelines are tabulated, as well as the mission sequence of operation. Design compatibility with most of the guidelines is verified and the corresponding data is included. A complete design description of the spacecraft is given, including a layout drawing and mass properties tabulations. The material included is primarily of a mechanical nature (with the exception of the antenna analysis). The attitude and orbit control requirements and design are described, and operation and hardware descriptions are included. Author

N71-28648*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

TIROS-M/ITOS MOMENTUM-WHEEL ASSEMBLY (MWA) REPORT

K. W. Edinger Mar. 1971 76 p refs
(NASA-TM-X-65529; X-481-71-83) Avail: NTIS CSCL 22B

The momentum-wheel assembly (MWA) is part of a three-axis system to stabilize the TIROS-M/ITOS spacecraft to a pointing accuracy of less than 1 degree in all three axes. The MWA was vigorously tested during its design period, then several units were successfully life tested in thermal vacuum for approximately 6 months. During spacecraft tests of TIROS-M, excessive brush wear developed with one of the redundant motors (motor 2), but the condition corrected itself and the MWA was considered to be flightworthy. During in-orbit engineering evaluation tests, additional excessive brush wear was attributed to inadequate thermal control of motor 2. Analysis and testing showed that installation of a heater would reduce the wear rate and ensure motor redundancy, and ITOS-A, B, and C MWA's include this modification. Author

N71-28689# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.

PROGRAM ELDOSE FOR CALCULATING THE DISTRIBUTION OF ABSORBED DOSES IN SPACE ENVIRONMENT AND CHARGED PARTICLE ACCELERATION THIN FILMS (PROTONS AND ELECTRONS) [PROGRAMME ELDOSE POUR LE CALCUL DES REPARTITIONS DE DOSES ABSORBEES DANS LES ECRANS MINCES EN ENVIRONNEMENT SPATIAL ET EN SIMULATION A L'ACCELERATEUR DE PARTICULES CHARGEES (PROTONS - ELECTRONS)]

J. Bourrieau and R. Schuttler Dec. 1970 34 p refs In FRENCH
(ONERA-NT/02/20/70) Avail: NTIS

A computer program for calculating the distribution of radiation dosage during a satellites exposition to a space environment proton and electron flux is described. This computer program is useful for predicting the particle flux distribution on a given orbit and then for adjusting the irradiation parameters (flux and energy) to a particle accelerator simulation. Author (ESRO)

N71-28696# Royal Aircraft Establishment, Farnborough (England).

SPACE VEHICLES LAUNCHED BETWEEN 1 SEPTEMBER AND 31 DECEMBER 1970, SUPPLEMENT

H. Hiller and J. A. Pilkington Jan. 1971 4 p
(RAE-TR-70163-Suppl) Avail: NTIS

RAE Technical Report 70163 lists all space vehicle launchings up to 1 September 1970. This supplement extends the tabulation up to 31 December 1970. Some amendments to Technical Report 70163 have also been included. Author (ESRO)

N71-28803*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

AERODYNAMIC CHARACTERISTICS OF A BOOSTER AND AN ASCENT SHUTTLE CONFIGURATION FROM MACH 0.28 TO MACH 10.4

Peter T. Bernot and Jarrett K. Huffman Washington May 1971 63 p refs
(NASA-TM-X-2265; L-7628) Avail: NTIS CSCL 22B

Force tests of a two-stage fully reusable shuttle concept were performed over a Mach number range of 0.28 to 10.4. Longitudinal and some lateral-directional aerodynamic characteristics were obtained for the booster and the ascent configuration comprised of the booster and HL-10 orbiter. Also, trimmed characteristics for the booster are presented at subsonic and hypersonic speeds. An interference-drag parameter for the ascent configuration over the speed range is also presented. Author

N71-25832*# North American Rockwell Corp., Downey, Calif. Space Div.
ORBITING LUNAR STATION PHASE A FEASIBILITY AND DEFINITION STUDY. VOLUME 1: OLS OBJECTIVES Final Report
Apr. 1971 289 p refs
(Contract NAS9-10924)
(NASA-CR-115015; SD-71-207-Vol-1) Avail: NTIS CSCL 22B

The OLS operational objectives, science objectives, and science support requirements are documented. The general operational objectives are: (1) maintain capability for initiation of operations through earth launch, earth orbital checkout, mating and transfer operations, cislunar flight, lunar orbit establishment, and quiescent lunar orbit storage; (2) operate effectively as a base of lunar operations for cislunar shuttle flights, lunar tug sorties, and lunar surface base support; (3) provide operational support for lunar orbit experiments and habitation for an eight-man crew for an operational period of 10 years; and (4) support the operations of other lunar exploration elements by providing communications, command and control capabilities, and emergency provisions. Author

N71-25833*# North American Rockwell Corp., Downey, Calif. Space Div.
ORBITING LUNAR STATION PHASE A FEASIBILITY AND DEFINITION STUDY. VOLUME 2: MISSION OPERATIONS Final Report
Apr. 1971 197 p refs
(Contract NAS9-10924)
(NASA-CR-115016; SD-71-207-Vol-2) Avail: NTIS CSCL 22B

The OLS functional requirements that support the operational objectives are derived. The functional analyses presented are: orbit determination, crew activities, autonomous operations, safety and rescue, communication requirements and lunar relay concepts, operations sequencing, propellant management, docking operations, and payload accommodations. Author

N71-25834*# North American Rockwell Corp., Downey, Calif. Space Div.
ORBITING LUNAR STATION PHASE A FEASIBILITY AND DEFINITION STUDY. VOLUME 3: OLS PERFORMANCE REQUIREMENTS Final Report
Apr. 1971 204 p refs
(Contract NAS9-10924)
(NASA-CR-115017; SD-71-207-Vol-3) Avail: NTIS CSCL 22B

Systems analyses were performed to determine the OLS preliminary design criteria, including subsystems functional and performance requirements supporting these identified OLS objectives and functions. These requirements, which include OLS overall design criteria, mission operational requirements, and subsystem and provisions requirements, are presented. Overall design criteria, mission, and experiment provisions requirements are described, along with crew and habitability provisions, docking provisions, and subsystem requirements. Author

N71-25835*# North American Rockwell Corp., Downey, Calif. Space Div.
ORBITING LUNAR STATION PHASE A FEASIBILITY AND DEFINITION STUDY. VOLUME 4: CONFIGURATION AND SYSTEMS ANALYSIS Final Report
Apr. 1971 634 p refs
(Contract NAS9-10924)
(NASA-CR-115018; SD-71-207-Vol-4) Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

Parametric OLS configuration design and selection trade study data for various OLS subsystem options are presented. No configuration design or subsystem concept selections are made. The data were utilized, however, to select design configurations and subsystems concepts for the representative OLS (20 to 33-foot diameter vehicle) and the derivative OLS (based on the earth orbiting modular space station). Author

N71-25836*# North American Rockwell Corp., Downey, Calif. Space Div.
ORBITING LUNAR STATION PHASE A FEASIBILITY AND DEFINITION STUDY. VOLUME 5: OLS CONFIGURATION DEFINITION Final Report
Apr. 1971 473 p refs
(Contract NAS9-10924)
(NASA-CR-115019; SD-71-207-Vol-5) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

Two configurations were derived, a representative OLS and an adaptation of an earth orbital modular space station, identified as the derivative OLS. The synthesis of the two configurations is presented. Author

N71-25883*# Cook Electric Co., Morton Grove, Ill. Tech-Center Div.
AEROBEE 350 RECOVERY SYSTEM Final Project Report
28 Dec. 1970 100 p refs
(Contract NAS5-10370)
(NASA-CR-118628) Avail: NTIS CSCL 22B

Three recovery systems for retrieving scientific payloads from Aerobee 350 sounding rocket vehicles were designed and fabricated, also development, qualification, and field tested in aircraft drops. The units utilize a two-stage aerodynamic decelerator system with associated timing, programing, and control circuitry. The equipment is described in detail, and the preliminary aerodynamic, thermal, and structural analyses are discussed. The development tests are covered, including structural integrity, separation system, first and second stage decelerator deployment, air drop, pyrotechnic initiation, electrical system performance, shock survival, and high temperature pulse tests. The qualification and acceptance test program and the field drop tests are also discussed. Field checkout units were designed and built for the field drop tests; their operation is described. Author

N71-25933*# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
THE STABILITY OF MOTION OF SATELLITES WITH FLEXIBLE APPENDAGES Semiannual Technical Progress Report, 1 Oct. 1970 - 31 Mar. 1971
Leonard Meirovitch Mar. 1971 44 p refs
(Grant NGR-36-004-042)
(NASA-CR-118639; SATR-3) Avail: NTIS CSCL 22B

The stability of motion of a satellite consisting of a main rigid body and three pairs of flexible booms, coinciding with the principal axes of the body in undeformed state, is under consideration. The problem formulation is a hybrid one, in the sense that some of the generalized coordinates depend on time alone and the other depend on spatial position and time. The problem is transformed into a discrete one by means of modal analysis. The motion stability is investigated by the Liapunov second method. A computer program was written and the numerical results are displayed in the form of stability diagrams using the system properties as parameters. Author

N71-25935*# National Aeronautics and Space Administration, Washington, D.C.
SPACECRAFT AERODYNAMIC TORQUES: SPACE VEHICLE DESIGN CRITERIA (GUIDANCE AND CONTROL)
Jan. 1971 37 p refs
(NASA-SP-8058) Avail: NTIS CSCL 22B

An assessment is made of distrubance torques due to the interaction of spacecraft with the atmosphere in comparatively long duration orbits. Formulas are derived for calculation of: (1) the total aerodynamic force acting on the vehicle, (2) the total aerodynamic

torque on the spacecraft, (3) the aerodynamic coefficients in free molecular flow, and (4) the location of the spacecraft center of mass relative to the center of pressure. The effects of aerodynamic torques on various types of spacecraft are discussed along with a general procedure for torque analysis in the design of spacecraft. D.L.G.

N71-26836*# Man Factors, Inc., San Diego, Calif.
A HUMAN FACTORS STUDY OF SHUTTLE/SPACE STATION CARGO HANDLING TECHNIQUES Final Report
C. A. Oakman and W. E. Woodson Feb. 1971 275 p refs
(Contract NAS8-26349)
(NASA-CR-103118; MF1-71-102) Avail: NTIS CSCL 22B

The amount of human involvement in cargo transfer vs the alternate potential of automated transfer systems was studied, and the in-space handling between an attached crew cargo module and the space station was investigated. This included handling of cargo as it would be acquired from the crew cargo module stowage spaces, transferred through the space station hatch, transported within the central tunnel to a point where it would be received at a particular space station deck for interim stowage, and finally as it returns to the crew cargo module. Only IVA tasks and hard equipment and packages were considered. A major conclusion is that the entire cargo transfer problem has received too little attention with the result that, at current levels of emphasis, transfer subsystem hardware and procedural requirements have no impact on overall mission concept development or hardware design. Author

N71-26022# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN INTRODUCTION TO ROCKETS AND GUIDED MISSILES
Chia-Kang Yeh 18 Nov. 1970 11 p Transl. into ENGLISH from Hang K'ung Chih Shih (Peking), no. 2, 1960 p 13–15
(AD-720382; FTD-HT-23-576-70) Avail: NTIS CSCL 19/7

A short description is given of the history of rocketry in China plus praise of Soviet accomplishments with satellites and rocket accuracy to 1960. Descriptions are made of capabilities, functions, and minor advantages and disadvantages of air-to-ground, air-to air, ground-to-ground, ground-to-air, and ground-to-space rockets. An explanation of the structure of rockets in general includes nose section, instrument compartment, fuel compartment, fuel feed system, engine, and control mechanism. A short discussion of requirements and capabilities of intercontinental missiles follows structural diagram of a Thor IRBM. GRA

N71-26040*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HYPERVELOCITY IMPACT TESTS ON A PROPOSED LUNAR TUG FUEL TANK CONFIGURATION
David William Jex 16 Apr. 1971 27 p
(NASA-TM-X-64597) Avail: NTIS CSCL 22B

The testing of a proposed configuration for lunar tug fuel tanks impacted by an aluminum projectile is discussed. The subsequent damage incurred is described and evaluated. Also schematic diagrams and actual photographs of the impact damage are included. Author

N71-26051*# National Aeronautics and Space Administration, Washington, D.C.
NASA SPACE SHUTTLE TECHNOLOGY CONFERENCE. VOLUME 1: AEROTHERMODYNAMICS, CONFIGURATIONS, AND FLIGHT MECHANICS
Apr. 1971 730 p refs Conf. held at Langley Station, Va., 2–4 Mar. 1971
(NASA-TM-X-2272; L-7737-Vol-1) Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

The technology assessment for the reusable space shuttle vehicle covers the related fields of aerodynamic and configuration optimization and operational flight mechanics. Aerodynamic heating and heat transfer simulations as well as thermal protection systems analyses are included. For individual titles, see N71-26052 through N71-26073.

N71-26063*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CONTROL AND HANDLING QUALITIES OF SPACE SHUTTLE ORBITERS
Richard W. Powell, James J. Adams, and Lawrence W. Brown *In its* NASA Space Shuttle Technol. Conf., Vol. 1 Apr. 1971 p 375–391 (See N71-26051 14-31)
Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

Analyses of the angle of attack transitions for a low cross-range straight wing orbiter in the terminal portion of its trajectory show that: (1) a supersonic transition provides substantial increase in gliding flight time over the subsonic transition for a straight wing orbiter design; (2) a two step horizontal tail deflection program provides for a gradual transition; and (3) some lateral stability augmentation is required supersonically at low angles of attacks. Initial studies for a delta wing shuttle configuration indicate a requirement for supplemental reaction jets in roll and yaw to insure aerodynamic control. G.G.

N71-26067*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
THE DELTA BODY: A POTENTIAL SPACE SHUTTLE ORBITER
Grover L. Alexander *In* NASA, Washington NASA Space Shuttle Technol. Conf., Vol. 1 Apr. 1971 p 493–537 refs (See N71-26051 14-31)
Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

Incorporation of technology requirements into a computerized delta body orbiter design approach provided the following improvements: (1) bow shock impingement and flow interference is avoided; (2) only the nose cap experiences surface temperatures above 1644 K; (3) static aerodynamic stability and control is provided for all three axis during atmospheric flight; (4) low structural weight is achieved; (5) a simple development manufacturing approach is provided; and (6) the delta body space shuttle orbiter can perform the required mission. G.G.

N71-26068*# General Dynamics/Convair, San Diego, Calif. Aerospace Div.
SPACE SHUTTLE SEPARATION SYSTEM
Frank Jarlett *In* NASA, Washington NASA Space Shuttle Technol. Conf., Vol. 1 Apr. 1971 p 539–579 (See N71-26051 14-31)
Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

Candidate separation system concepts for a reusable space shuttle booster configuration are evaluated by computerized simulations. Comparison of links, rockets, pistons, and rails at three points in the trajectory show that the use of orbiter thrust is poor at normal staging and not acceptable for abort. Rocket and piston concepts have excellent separation characteristics at normal staging, but incur significant penalties for abort. The link concept, using booster thrust, has the inherent capability to provide immediate separation along the entire boost trajectory for negligible penalties. G.G.

N71-26069*# Boeing Co., Seattle, Wash.
FLIGHT DYNAMICS OF A STRAIGHT WING SPACE SHUTTLE BOOSTER DURING ENTRY
L. G. Kimbrel and J. T. Patha *In* NASA, Washington NASA Space Shuttle Technol. Conf., Vol. 1 Apr. 1971 p 581–610 ref (See N71-26051 14-31)
Avail: NTIS HC $9.00/MF $0.95 CSCL 22C

Critical problem areas are investigated for a straight-wing space shuttle booster during entry. A six-degree-of-freedom entry

simulation is utilized to study vehicle dynamics and control system requirements which include attitude control propulsion system (ACPS) propellant usage requirements. Linear analysis is utilized to supplement the nonlinear simulation where a critical problem requires additional definition. A modified Apollo control law was found to be optimum for attitude control propulsion system propellant usage and dynamic behavior in the presence of wind disturbances. However, the particular vehicle lateral-trim characteristics are equally important and the incorporation of variable dead bands for different flight phases is recommended. G.G.

N71-26070*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
BOOSTER WING GEOMETRY TRADE STUDIES
H. G. Struck and J. E. Butsko (General Dynamics/Convair, San Diego, Calif.) *In its* NASA Space Shuttle Technol. Conf., Vol. 1 Apr. 1971 p 611-642 (See N71-26051 14-31)
Avail: NTIS HC$9.00/MF$0.95 CSCL 22B

The subsonic aircraft mode of a space shuttle booster establishes design requirements on airbreathing engine size and flyback fuel allotment. Trade study results show the influence of wing geometry variations on the flyback systems weight of a canard space shuttle booster. The influence of such wing geometry parameters as aspect ratio, wing area, and thickness ratio is discussed. For other than cruise performance reasons, a lower limit of wing area is defined; the influence of other phases of the booster mission profile, including launch, entry, and landing is presented. Aspect ratio, however, is influenced primarily by cruise performance and cost considerations. The influence of ground rules, such as choice of flyback fuel, headwind profile, and required range is discussed. Author

N71-26071*# Grumman Aerospace Corp., Bethpage, N.Y.
ORBITER ENTRY TRAJECTORY CONTROL. 1: HIGH SPEED ENTRY PHASE
J. McNamara *In* NASA, Washington NASA Space Shuttle Technol. Conf., Vol. 1 Apr. 1971 p 643-674 refs (See N71-26051 14-31)
Avail: NTIS HC$9.00/MF$0.95 CSCL 22C

The thermal environment experienced during entry is a major factor in the design of the shuttle onboard guidance navigation and control system. Reference heating rate profiles, characterized by a second maximum subsequent to transition to turbulent flow, penalize the weight and cost of the thermal protection system design for both the upper and lower vehicle surfaces. A method of combining heat pulse shaping with control of applied acceleration and terminal targets is presented. The interaction of various system elements with thermal and load factor environment is evaluated. A drag control method of entry guidance is used to shape the reference heating pulse, control the load factor, and steer to a specific target within a specified cross range mode footprint. Author

N71-26072*# Grumman Aerospace Corp., Bethpage, N.Y.
ORBITER ENTRY TRAJECTORY CONTROL. 2: TERMINAL PHASE ENTRY
L. Weiss *In* NASA, Washington NASA Space Shuttle Technol. Conf., Vol. 1 Apr. 1971 p 675-690 (See N71-26051 14-31)
Avail: NTIS HC$9.00/MF$0.95 CSCL 22C

The energy management procedures required to target the orbiter to the landing site in the subsonic phase of unpowered reentry are defined. A simple approximate analysis of low speed, constant load factor spiral glide descents is employed; it is based on quasi-steady equilibrium glides flown at constant equivalent airspeeds and bank angles, and it accounts for the variation of atmospheric density. Energy management windows are defined for a delta wing orbiter with known aerodynamic characteristics; they indicate the targeting capabilities of the unpowered vehicle in terms of altitude, required change in heading angle, ground distance between the vehicle and the target point, and required velocity at target. Flight test results of X-15, HL-10, X-24, and F-104 glide landings are in good agreement with this procedure. An investigation of existing auto-land systems indicates that the microwave scanning beam can accommodate the higher glide slopes associated with unpowered landings. Author

N71-26073*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
MINIMUM SHUTTLE THERMAL PROTECTION SYSTEM WEIGHT THROUGH TRAJECTORY SHAPING
Henry W. Kipp and David O. Swain *In* NASA, Washington NASA Space Shuttle Technol. Conf., Vol. 1 Apr. 1971 p 691-749 (See N71-26051 14-31)
Avail: NTIS HC$9.00/MF$0.95 CSCL 22B

The influence of various types of entry control on thermal protection system requirements for a 2778 kilometer crossrange mission are studied. The types of entry control analyzed are: (1) bank angle and angle of attack are held constant; (2) modulate bank angle while maintaining a constant angle of attack; and (3) modulate bank angle in conjunction with a modulating angle of attack. Near optimal control profiles have been determined by employing a steepest descent computer simulation to solve maximum cross-range for a fixed angle of attack and to minimize stagnation total heat with a varying bank angle and angle of attack. Each entry trajectory is analyzed to estimate the weight requirements for a metallic and a non-metallic TPS system and to determine the interaction between the type of TPS and the entry trajectory shaping philosophy. It is found that minimum weight thermal protection systems depend on the minimum entry temperature that can be flown and the required cross-range; entry trajectory shaping is necessary to minimize orbiter thermal protection system weight. Author

N71-26080*# National Aeronautics and Space Administration, Washington, D.C.
PREVENTION OF COUPLED STRUCTURE-PROPULSION INSTABILITY (POGO). NASA SPACE VEHICLE DESIGN CRITERIA, STRUCTURES
Oct. 1970 51 p refs
(NASA-SP-8055) Avail: NTIS CSCL 22B

A summary and appraisal are presented of technology for the prevention of pogo. The material includes: (1) formulation of mathematical models of the structural and propulsion systems, (2) analytical and experimental derivation of model parameters, (3) methods of pogo stability analysis, (4) approaches for modifying vehicle systems to suppress instability, and (5) validation of stability achievement by analysis of flight data. D.L.G.

N71-26093# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ROCKETS AND MATERIALS
Yun-Shu Wu 26 Jun. 1970 11 p Transl. into ENGLISH from Hang K'ung Chih Shih (Mainland China), v. 1, no. 2, 1964 p 6-7
(AD-720586; FTD-HT-23-302-70) Avail: NTIS CSCL 21/8

Material problems of liquid rockets (Warhead materials, Materials of propellant tanks, Materials of liquid rocket engine combustion chambers); Material problems of solid rockets (Casing materials, Exhause nozzle materials). GRA

N71-26096*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
SHUTTLE SIMULATION
Alberta King and Maurice Knighton 10 May 1971 70 p
(NASA-TM-X-64592) Avail: NTIS CSCL 22B

The unique concepts of the Space Shuttle and the varied environments of its typical missions require a different analysis approach from previous launch vehicles. This becomes apparent when the reusability concept is analyzed. Since man will generally

be on board, maximum utilization of his adaptive capabilities is highly desirable. To properly analyze the interactions of man, machine, and environment, and to have the capability of analyzing automatic guidance and control concepts, a special simulation tool is required. The present simulation concept, its capabilities, and future development plans are presented. Included also are the 6-D equations of motion in modular form so that simulation of the various concepts (control) can be made easily. Detailed descriptions of the cockpit and visual displays are shown. Author

N71-26151# Research Inst. of National Defence, Stockholm (Sweden).
DIFFERENT METHODS OF MANUFACTURING A PRESSURE VENT FOR ROCKET MOTORS [OLIKA METODER FOER TILLVERKNING AV SPANNINGSAULASTARE FOER RAKETMOTORER]
Gunnar Soederberg Dec. 1969 16 p
(FOA-2-C-2361-42) Avail: NTIS

Experiences of three different manufacturers and of different fixing methods for pressure vents in rocket motors are reported. These are based on the following principles: (1) casting of a liquid elastomer (CTPB) which hardens in heat; (2) glueing of prefabricated flap, and (3) fixing and vulcanizing direct in the motor (formation of rubber bag). The arguments for and against the methods are discussed. It appears from the results that glueing of completed flaps is the quickest and cheapest way to apply pressure vents in rocket motors. Author

N71-26370*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
DESIGN OF AN INERT FLUID INJECTION SYSTEM, PHASE 3 Final Report
L. R. Baker, Jr. and P. T. Johnson Nov. 1970 155 p refs
(Contract NAS5-11614)
(NASA-CR-118488; LMSC/HREC-D162662; HREC-1614-4) Avail: NTIS CSCL 22B

A system has been designed which will accomplish the velocity trim by injecting an inert propellant into the Delta third stage motor after burnout. The heat stored in the motor case is utilized to augment the propulsive energy of the injected fluid. In such a system, the inert fluid is sprayed into the motor chamber where it either changes phase instantaneously, or contacts the heated surface of the motor case and subsequently vaporizes. The mass of inert fluid which can be vaporized by this system is dependent on the amount of heat which can be stored in the spent rocket motor case. The heated vapor is then expanded to ambient conditions through the converging-diverging nozzle of the rocket motor, yielding a useful thrust level. A relatively low thrust system results from this approach. Author

N71-26465*# Philco-Ford Corp., Palo Alto, Calif. Western Development Labs. Div.
STUDY OF THE EFFECT OF SPACECRAFT WINDOW CONFIGURATION ON LINES OF SIGHT
David M. Kelley Jan. 1971 142 p refs
(Contract NAS2-5044)
(NASA-CR-114310) Avail: NTIS CSCL 22B

The results of a study of pressure deformations of spacecraft windows and the angular line-of-sight deviations of light rays passing through the windows which result from these deformations are detailed. These studies show the effects of varying the pane shape, pressure differential, dimensional scale, pane thickness, edge support condition and incidence angle. The results of a computer survey of line-of-sight deviations associated with various design parameters are calculated for elliptical, rectangular, and trapezoidal planforms. Plots of mean and root mean square deviations of light rays for various incidence angles and incidence planes are given, also information on the retrieval of the design data from microfilms and computer tapes. Author

N71-26537* Westinghouse Electric Corp., Pittsburgh, Pa.
BEARING AND GIMBAL LOCK MECHANISM AND SPIRAL FLEX LEAD MODULE Patent
Wayne B. Lloyd, Inventor (to NASA) Issued 12 Jan. 1971 9 p
Filed 18 Mar. 1969 Cl. 244-1; Cl. 74-5.12; Cl. 308-1; Int. Cl. B64g1/00 Sponsored by NASA
(NASA-Case-GSC-10556-1; NASA-Case-GSC-10557-1; US-Patent-3,554,466; US-Patent-Appl-NS-805193) Avail: US Patent Office CSCL 22B

A two-axis gimbal supported payload of an orbital spacecraft is described. In normal orbit operation, the gimbal is supported along each of its rotational axes by a sleeve and thrust bearing assembly permitting pivotal motion of the gimbal in response to relatively low amplitude loads occasioned by orbital forces. Initially, the sleeve and thrust bearings are disengaged from the gimbal and a gimbal lock mechanism restrains pivotal motion of the gimbal during launch of the spacecraft. The gimbal lock mechanism contains the sleeve and thrust bearings and isolating them from contaminants until attaining a required orbit. A spring motor is actuated to disengage the gimbal lock mechanism and engage the sleeve and thrust bearings subsequent to launch. Electrical conductors in the form of metal strips, together with an associated insulating strip, are wrapped spirally about a rotational axis of the gimbal to provide power conduction to the gimbal payload. Official Gazette of the U.S. Patent Office

N71-26648*# Vacudyne Corp., Chicago Heights, Ill.
SPECIFICATIONS FOR ENVIRONMENTAL LABORATORY TEST CHAMBER COMPLEX Final Design Document
15 May 1971 177 p refs
(Contract NAS9-11063)
(NASA-CR-115007) Avail: NTIS CSCL 22B

Requirements are outlined for furnishing all necessary labor and materials to design, fabricate, deliver, install and test a complete environmental laboratory test chamber complex. Author

N71-26585*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO 11 MISSION ANOMALY REPORT 3: SERVICE MODULE ENTRY
Nov. 1970 14 p
(NASA-TM-X-67183; MSC-03466) Avail: NTIS CSCL 22B

During Apollo 11 reentry, the service module was seen by the crew about 5 minutes after it had been jettisoned which could not have occurred if the service module had followed its expected trajectory. An investigation was conducted to determine the cause of this anomaly and to establish necessary corrective actions. The results indicate that: (1) tip-off moments applied to the service module at jettison cause the spin vector to be misaligned with the service module X-axis; (2) the rigid body spin motion of the service module excites longitudinal slosh of the propellants which then becomes the dominant force causing the spin vector to approach a position normal to the service module X-axis; and (3) the sloshing can orient the service module spin axis such that the net -X thrusting over a period of 300 seconds can not only reduce the separation velocity of the service module but also reverse its direction. In addition, it was found that an optimum separation velocity can be obtained for a range of propellant loads by restricting the spin thrusting to 2 seconds and the X-axis thrusting to 25 seconds of firing time. D.L.G.

N71-26766*# North American Rockwell Corp., Downey, Calif. Space Div.
NUCLEAR FLIGHT SYSTEM DEFINITION STUDY, PHASE 3. VOLUME 2: CONCEPT AND FEASIBILITY ANALYSIS. PART B: BASELINE SYSTEM DEFINITION Final Report
D. Garcia Apr. 1971 183 p refs
(Contract NAS8-24975)

(NASA-CR-103143; SD-71-466-3) Avail: NTIS CSCL 22B

The detail design of the baseline reusable nuclear shuttle configuration is presented including engineering drawings, subsystems, schematics, components, mass properties, and interface requirements. A brief description of each subsystem and the design criteria and constraints are also given. Author

N71-26767*# North American Rockwell Corp., Downey, Calif. Space Div.

NUCLEAR FLIGHT SYSTEM DEFINITION STUDY, PHASE 3. VOLUME 2: CONCEPT AND FEASIBILITY ANALYSIS. PART C: SYSTEM ENGINEERING DOCUMENTATION Final Report

A. R. Jusak Apr. 1971 251 p

(Contract NAS8-24975)

(NASA-CR-103144; SD-71-466-4-Vol-2-Pt-C) Avail: NTIS CSCL 22B

The engineering process methodically considers the total system in approaching the problem of utilizing the reusable nuclear shuttle in performing its missions. Gross system requirements for the three mission classes are identified in the system specification. These requirements are translated to functions and documented in functional flow diagrams. The functions in turn are translated into design requirements and are documented in requirements allocation sheets. Timelines for major functions are also provided. Author

N71-26780*# Grumman Aerospace Corp., Bethpage, N.Y.

ALTERNATE SPACE SHUTTLE CONCEPTS VOLUME 2: CONCEPT DEFINITION, PLANNING AND COST DATA. PART 1: CONCEPT ANALYSIS AND DEFINITION (APPENDICES C THRU F) Midterm Report, Jul.–Dec. 1970

31 Dec. 1970 451 p refs

(Contract NAS9-11160)

(NASA-CR-118487; B35-43RP-5) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

Materials and thermal protection systems, propulsion, environmental control and life support systems, and crew and passenger accommodation data are presented for concept analysis and definition of a fully reusable two-stage-to-orbit space shuttle. Aluminum, nickel, cobalt, and titanium alloys, nonmetallic materials, and C4 booster primary structure materials are outlined for thermal protection. Engines, booster and auxiliary propulsion systems, orbit maneuvering systems, and solid rocket motor performance data are summarized including "A" and "C" configurations. Heat transport and radiator loop design parameters, booster environmental control systems, and carbon dioxide and humidity control for the cabin atmosphere are covered. Size, shape, and interior arrangement data in orbiter vehicles are emphasized for crew and passenger accommodations. J.M.

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N71-25619# Brown Univ., Providence, R.I. Div. of Applied Mathematics.

APPROXIMATE SOLUTIONS TO SOME STATIC AND DYNAMIC OPTIMAL STRUCTURAL DESIGN PROBLEMS

Raymond H. Plaut [1971] 28 p refs Sponsored in part by AROD

(Grant N00014-67-A-0191-0009)

(AD-719924) Avail: NTIS CSCL 13/13

Considered in this paper are problems of optimal structural design for minimum static deflection, minimum dynamic deflection, maximum fundamental frequency, and maximum stability. A procedure based on the Ritz method is proposed which yields approximate solutions to these problems when the design is characterized by a discrete set of design parameters. Examples involving elastic beams and rods are presented to demonstrate the applicability and efficiency of the procedure. Author (GRA)

N71-25704*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

FINITE ELEMENT MODELING STUDIES IN THE NORMAL MODE METHOD AND NORMAL MODE SYNTHESIS

Roy Leon Courtney (M.S. Thesis–George Washington Univ.) Washington May 1971 48 p refs

(NASA-TN-D-6326; G-1009) Avail: NTIS CSCL 20K

This report compares the results of finite element and analytic solutions of the normal modes of a uniform beam under various end conditions. The normal modes of a single component are synthesized to represent different single component and multi-component structures. The results are compared for accuracy with the analytic structural solutions. Guidelines for finite element structural modeling are developed which determine the minimum number of elements required to obtain specified levels of accuracy in normal mode analysis and synthesis. The finite element modeling studies are implemented on NASA's NASTRAN structural analysis computer program. Modeling techniques that represent a part of a structure by its normal modes in a computer structural analysis are presented. Author

N71-25705# Martin Marietta Corp., Denver, Colo.

THE INFLUENCE OF ENVIRONMENT AND THE SURFACE LAYER ON CRACK PROPAGATION AND CYCLIC BEHAVIOR Annual Report

I. R. Kramer and A. Kumar Feb. 1971 60 p refs

(Contract F44620-69-C-0065)

(AD-719870; MCR-71-57; AFOSR-TR-71-0555) Avail: NTIS CSCL 20/11

The paper shows that environment has a marked effect on the surface layer stress, and in turn the surface layer has a large influence on crack propagation and cyclic work hardening and softening. The relaxation and formation of the surface layer controls the cyclic creep behavior. In particular, measurements of the surface layer stress during cyclic hardening and softening demonstrated that the change in the applied stress was equal to the change in the surface layer stress. The decrease in the cyclic hardening of specimen deformed in vacuum can be explained on the basis that the surface layer stress is less for specimens deformed in vacuum than for those deformed in air. It was found that media that cause stress corrosion cracking also increase the surface layer stress. An increase in the surface layer stress was found to increase the crack propagation rate. Author (GRA)

N71-25757# Joint Publications Research Service, Washington, D.C.

ESTIMATE OF THE STRENGTH STABILITY OF STRUCTURAL FIBERGLASS IN CONICAL SHELLS

Yu. N. Ivonin et al 13 May 1971 10 p refs Transl. into ENGLISH from Mekhan. Polimerov, Akad. Nauk Latv. SSR (Riga), no. 1, 1971 p 102–108

(JPRS-53118) Avail: NTIS CSCL 20K

The difference in the mechanical characteristics (extension, compression) is shown between layered glass reinforced plastic produced in the laboratory and in the factory by the method of laying up of dry fabric with subsequent saturation with binder under pressure in a closed form. The stability of the strength properties of fiber glass as produced in various conical load-bearing shells made in large groups is studied. Several experimental dependences

of the properties of the materials on the total number of shells made are presented. Author

N71-25758# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE VIBRATIONS OF BODIES SUBMERGED IN A FLUID SUBJECTED TO AN ACOUSTIC WAVE
S. N. Rzhevkin [1971] 9 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Fiz. Astron. (USSR), No. 1, 1971 p 52–61
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Various methods of solving the problem of the vibrations of spheres and cylinders submerged in a fluid subjected to a plane acoustic wave with velocity amplitude v sub 0 are considered. Author

N71-25787# Lockheed Missiles and Space Co., Palo Alto, Calif.
FREE VIBRATIONS OF NONLINEARLY ELASTIC SHELLS
V. N. Pastushikhin 27 Feb. 1970 5 p refs Transl. into ENGLISH from Prikl. Mekh. (Ukrainia SSR), v. 7, no. 3, 1971 p 16–20
Avail: NTIS

Shell vibrations under finite deflections, including shells of linearly elastic material, were investigated to obtain a solution in a general form. Equations of motion are given for a physically and geometrically nonlinear shallow shell with deflections several times greater than the thickness but much less than the size of the shell planform. A simply-supported shallow spherical shell of square planform is examined. Results show that motion of systems with a physical nonlinearity predominant over the geometric differ quantitatively from those for geometrically nonlinear systems. For the former, the motion is not oscillatory for large initial perturbations; the displacements increase monotonely with time resulting in rapid fracture. E.C.

N71-25790*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUPERSONIC ASYMMETRIC FLUTTER AND DIVERGENCE OF TRUNCATED CONICAL SHELLS WITH RING SUPPORTED EDGES
Sidney C. Dixon and M. Latrelle Hudson Washington May 1971 25 p refs
(NASA-TN-D-6223; L-7527) Avail: NTIS CSCL 20K

The flutter of truncated conical shells supported at the ends by rings was studied analytically. The basic flutter characteristics were determined, and the effects of shell geometry on these characteristics were investigated. Three types of flow-induced instabilities were found: flutter in two circumferential waves, divergence in two circumferential waves, and flutter in many circumferential waves. For end rings that were not very stiff, the instabilities could occur at dynamic pressures that were orders of magnitude less than the values obtained for shells with simple or clamped edge support. For shells free of external static loading, prevention of divergence required the stiffest end rings for small cone angles and prevention of flutter in two circumferential waves required the stiffest end rings for large cone angles. Flutter in many circumferential waves was the critical mode of instability for all cone angles when the end rings were very stiff. This type of flutter occurred at dynamic pressures approaching the values required for shells with simple or clamped edge support. For shells subjected to static external-pressure loads, divergence governed design conditions for small values of cone angle, flutter for moderate values of cone angle, and buckling for large values of cone angle. Author

N71-25794# Lockheed Missiles and Space Co., Palo Alto, Calif.
NATURAL VIBRATIONS OF A CYLINDRICAL SHELL WITH ELASTIC CORE
B. A. Korbut [1971] 6 p refs Transl. into ENGLISH from Izv. Vyssh. Uchab. Zaved., Aviats. Tekh. (USSR), no. 4, 1970 p 137–141
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A closed cylindrical shell enclosing a solid (without holes) elastic core is considered. Its natural axisymmetric vibrations are studied. The vibrations frequencies and modes are determined for elastic constants of the core, as well as for diverse modifications for connecting the shell to the core. The core is modelled by an isotropic elastic solid whose motion is described by the general equations of three-dimensional elasticity theory in cylindrical coordinates. These equations are supplemented by boundary conditions on the endfaces and by conditions for connection to the shell. It is assumed that the core stiffness is significantly less than the stiffness of the shell material. This permits utilization of equations based on the Kirchhoff-Love hypothesis to describe motion. These are written in displacements with the addition of terms taking account of the core reaction. The motion equations of the shell and core in combination with the conditions for their connection and the appropriate boundary conditions are solved as a contact problem of the natural vibrations of a shell-core system. Author

N71-25802*# Scientific Translation Service, Santa Barbara, Calif.
THE INFINITE, ELASTICALLY SUPPORTED BEAM UNDER THE INFLUENCE OF A UNIFORMLY MOVING LOAD [DER UNENDLICHE FEDERND GEBETTETE BALKEN UNTER DEM EINFLUSS EINER GLEICHFOERMIG BEWEGTEN LAST]
J. Doerr Washington NASA May 1971 45 p refs Transl. into ENGLISH from Ing.-Arch (Berlin), v. 14, 1943, 1943 p 157–192
(Contract NASw-2035)
(NASA-TT-F-13569) Avail: NTIS CSCL 20K

The dynamic problem of an elastic beam on an elastic foundation under the influence of a moving single point load is solved using complex variable theory. The foundation has no inertia. A number of static and dynamic problems are solved for infinite, semi-infinite and finite beams. Two fundamentally different wave solutions exist, depending on the magnitude of the load velocity. Author

N71-25807# Catholic Univ. of America, Washington, D.C.
LARGE DEFLECTIONS OF FLAT ARBITRARY MEMBRANES
Robert Kao and Nicholas Perrone Feb. 1971 26 p refs
(Grant NSF GK-23747)
Avail: Issuing Activity

Displacement equations in Cartesian coordinates are solved to determine the large deflection response of flat membranes. Cases included are circular, rectangular, and polygonal membranes. For the last two cases an added complication is also treated consisting of a rigid central core region. The nonlinear relaxation method in conjunction with finite difference approximation is utilized to solve the governing differential equations. Comparisons, where possible, with other solutions are quite favorable. For rectangular membranes results are put in a form convenient for direct engineering use. Author

N71-25932# Arizona Univ., Tucson. Engineering Experiment Station.
NEW TECHNIQUES IN NONDESTRUCTIVE TESTING BY ACOUSTICAL AND EXO-ELECTRON EMISSION Semiannual Progress Report, 1 Sep. 1969–30 Apr. 1970
Robert H. Chambers and Stuart A. Hoenig 30 Apr. 1970 25 p
(Contract F33615-68-C-1707; ARPA Order 1244)
(AD-720358) Avail: NTIS CSCL 14/2

The report describes investigations of the frequency distribution of acoustical emission from growing fatigue cracks in 24-ST aluminum sheet. The fatigue cracks were introduced by a high-amplitude, low-cycle bending mode of deformation. Efforts

were also devoted to investigating the post fatigue exo-electron emission from nickel wires. GRA

N71-25964*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
RESPONSE OF A RING-STRINGER STIFFENED CYLINDER TO ACOUSTICAL AND MECHANICAL EXCITATION
Terry D. Scharton 7 Apr. 1971 90 p refs
(Contract NAS8-21439)
(NASA-CR-103172; Rept-1997) Avail: NTIS CSCL 20K

The results of the investigation confirm the feasibility of using small mechanical shakers attached to the skin of an aerospace vehicle section to simulate the response of the vehicle to acoustic excitation. The results also indicate that the skin vibration, vibration transmission to interior components, and interior sound field resulting from acoustical and mechanical excitations can be predicted adequately using statistical energy analysis techniques at frequencies greater than approximately three times the fundamental resonance frequency. Author

N71-26028*# Computer Sciences Corp., Los Angeles, Calif.
MEAN SQUARE EXCEEDANCE CHARACTERISTICS OF A SINGLE TUNED SYSTEM TO AMPLITUDE MODULATED RANDOM NOISE
Richard L. Barnoski and John R. Maurer Apr. 1971 172 p refs
(Contract NAS8-26233)
(NASA-CR-61352) Avail: NTIS CSCL 20K

An analysis is presented of exceedance characteristics in the mean square response of a single-tuned system to amplitude modulated noise of limited time duration. The input model is considered representative of gusts, earthquakes, initial ignition of boosters and automotive vehicle impacts; the results thus bear directly on the design/analysis/testing of structural systems subjected to such nonstationary random environments. A general formulation is reviewed for an envelope modulation of arbitrary form and noise of arbitrary correlation. Three modulation functions and noise with a damped cosine correlation are treated. For correlated noise, the time-varying mean square response may exceed the stationary value by a factor in excess of two; such exceedances do not occur for white noise. This behavior is summarized by parametric plots and explained in terms of a time-varying shaping filter. Author

N71-26033# National Aerospace Lab., Tokyo (Japan).
RESPONSE ANALYSIS OF A SIMPLY SUPPORTED PLATE TO BOUNDARY LAYER PRESSURE FLUCTUATIONS
Yoshinori Fujimori Sep. 1970 25 p refs In JAPANESE; ENGLISH summary
(NAL-TR-207) Avail: NTIS

The response cross-correlation of a simply-supported elastic panel is derived through the normal mode approach assuming an analytic formula for the space-time cross-correlation function of pressure fluctuations and non-interference between the vibration modes. Dynamic effect function and orientation sensitivity factor are proposed as suitable measures for estimating the dependency of each vibration mode on the pressure fluctuation in convecting velocity, and the response magnification due to the difference of flow directions, respectively. The physical meaning of these quantities based on a general theory of two-dimensional bending wave propagation are further clarified. Author

N71-26086# National Aerospace Lab., Tokyo (Japan).
ON THE VIBRATION OF AXIAL FLOW TURBOMACHINE BLADES. 2: THE VIBRATION DAMPING CAPACITY OF THE BLADE MOUNTING
Toshio Miyachi, Syoji Hoshiya, Yasushi Sofue, Saburo Amihoshi, and Takeo Kumagai Oct. 1970 41 p refs In JAPANESE; ENGLISH summary
(NAL-TR-218) Avail: NTIS

The vibration damping capacity of the rotor blade mounting was evaluated. The method consisted of measuring the logarithmic damping of the rotating blade system and calculating damping capacity of the mounting by the theory of forced vibration of the blade system. The following results were obtained: (1) The damping capacity of the dove-tail type or the de Laval type mounting is large compared with that of tightly fixed mounting at low rotor speed, but decreases rapidly with increase in the rotor speed; (2) The pin joint type mounting has the largest damping capacity when clearance ratio is 1 to 2%; (3) The damping capacity of loose mounting is considerably dependent on vibration amplitude at low rotor speed, but this amplitude dependency disappears at high rotor speed; and (4) The logarithmic damping of the blade system is approximately proportional to the chord length for the aerodynamically similar blade. Author

N71-26084# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
CREEP BUCKLING OF CIRCULAR CYLINDRICAL SHELLS IN PURE BENDING
Nicholas J. Hoff and Larry Wang Dec. 1970 25 p refs
(Contract N00014-67-A-0112-0003)
(AD-720768; SU-DAAR-417; TR-23) Avail: NTIS CSCL 20/11

The two simultaneous nonlinear first-order differential equations characterizing the problems that were derived by the senior author in a paper in 1956 and were at that time solved for a few cases by numerical integration are solved here analytically with the aid of a few simplifying assumptions. The very simple formula derived in this manner is used to compute the critical times of a series of shells tested in the laboratory. It is found that the formula predicts somewhat larger values for the critical time than the experimental results. Author (GRA)

N71-26087# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
AN EXPERIMENTAL STUDY OF THE CREEP BUCKLING OF MODERATELY THIN WALLED CIRCULAR CYLINDRICAL SHELLS SUBJECTED TO AXIAL COMPRESSION
Michel Benoit, Robert L. Sendelbeck, and Nicholas J. Hoff Dec. 1970 128 p refs
(Contract N00014-67-A-0112-0003)
(AD-720767; SU-DAAR-415; TR-22) Avail: NTIS CSCL 20/11

Test equipment suitable for the study of the creep buckling of axially compressed circular cylindrical shells was developed and built. With the aid of this equipment, thirty-one electroformed nickel cylinders of radius-to-thickness ratios ranging from 30.6 to 96.4 were tested at a temperature of 650F. The loading of each specimen was interrupted usually once, and in some cases twice, to permit an exact measurement of the creep deformations produced by the axial compression. Diagrams showing the deformed shapes of eight generators of each specimen are presented at two or three stages of the creep buckling process. Inspection of the figures reveals that specimens of this kind either buckle axisymmetrically, or begin the creep buckling process in a axisymmetric manner but change over to a multilobed pattern in later stages of the deformations. Author (GRA)

N71-26169# Brown Univ., Providence, R.I. Div. of Engineering.
THE DEFORMATION OF LEAD IN TORSION AT HIGH STRAIN RATES
J. Duffy, R. H. Hawley, and R. A. Frantz, Jr. Oct. 1970 31 p refs
(Grant NSF GK-4242)
(Rept-2) Avail: Issuing Activity

Experiments are described in which specimens of lead are strained in torsion at high rates using the split Hopkinson bar and explosive loading. Tests were conducted at nominal strain rates of 1000 per sec and 5000 per sec as well as at static rates. Values of the flow stress correspond closely with those obtained in axial

tests by other investigators. The percent difference in flow stress between static and dynamic loading is about the same for axial or torsional loading. Author

N71-26251# ARA, Inc., West Covina, Calif.
RESEARCH ON ENERGY ABSORBING STRUCTURES, PART 9 Final Annual Report, 1 Feb. 1970 – 1 Feb. 1971
Bernard Mazelsky, T. H. Lin, Sheng-Rong Lin, and Robert R. Hewitt 8 Feb. 1971 65 p refs
(Contract F44620-68-C-0041)
(AD-720844; ARA-129-Pt-9; AFOSR-TR-71-0127-Pt-9) Avail: NTIS CSCL 13/13

An analytical method for predicting the elasto-plastic bending of rectangular plates with large deflection is studied. The concept of equivalent body force is applied to account for the plastic strain gradients and the non-linear terms of displacement derivatives. The calculated deflection for purely elastic plates compares well with other existing solutions. The deflection is increased slightly by plastic strain; however, the stress is considerably relieved by plastic yielding. Nuclear Quadrupole Resonance(NQR) on dilute inert fillers in several polymers and adhesives is made as a function of compression and tension. The change in the NQR response is found to be proportional to the strain applied to the host material. NQR measurements on reinforced polymers and adhesive bonds are reported. Author (GRA)

N71-26262# Air Force Systems Command, Wright-Patterson AFB, Ohio. Flight Dynamics Lab.
EFFECT OF FIBER ORIENTATION ON INITIAL POSTBUCKLING BEHAVIOR AND IMPERFECTION SENSITIVITY OF COMPOSITE CYLINDRICAL SHELLS Technical Report, Dec. 1969 – May 1970
N. S. Khot and V. B. Venkayya Dec. 1970 86 p ref
(AD-720231; AFFDL-TR-70-125) Avail: NTIS CSCL 13/13

Koiters approach is used to formulate the influence of fiber orientation on the behavior of the cylindrical shell in the initial postbuckling region. Results are presented for three-layer composite cylindrical shells of either glass-epoxy or boron-epoxy subjected to uniform axial compressive load. The results show that the initial postbuckling coefficient that characterizes the extent of imperfection sensitivity of a structure is greater for the glass-epoxy shells than for the boron-epoxy shells. For the glass-epoxy cylinders the slope of the load vs. end-shortening curve in the initial postbuckling region is found to have high negative value, which is not significantly affected by the change in fiber orientation. This suggests that the buckling of a nearly perfect glass-epoxy cylinder under prescribed end-shortening will be catastrophic, regardless of fiber orientation. However, for the boron-epoxy cylinders the negative slope varies with the change in fiber orientation, and whether the failure will be catastrophic or not will depend on the fiber orientation. Author (GRA)

N71-26253 Brown Univ., Providence, R.I.
THE STRESS PULSES PRODUCED BY BRITTLE FRACTURE OF RODS, PART 1. A METHOD FOR DETERMINING MATERIAL PROPERTIES AT HIGH RATES OF SHEARING STRAIN, PART 2
James Woodward Phillips (Ph.D. Thesis) 1969 118 p
Avail: Univ. Microfilms Order No. 70-8777

Theoretical and experimental investigations of the unloading stress pulses produced in brittle circular rods when they fracture in uniaxial tension have been carried out. A simple fracture model is developed for the generation of longitudinal and flexural stress pulses within the fracture zone, and Fourier techniques are employed to predict the ever-changing shapes of these pulses as they propagate in both axial directions away from the fracture zone. The details of an experimental program suitable for determining the mechanical properties of certain materials at high rates of shearing strain are given. The major contribution of this work is a description of a successful method for producing sharp torsional pulses in the main loading rod of a torsional split-Hopkinson bar, by means of the simultaneous detonation of two explosive charges at the ends of long pre-load bars in contact with the main loading rod. Dissert. Abstr.

N71-26318 Brown Univ., Providence, R.I.
LIMIT ANALYSIS OF PRESSURIZED CYLINDERS WITH SLITS
David Christopher McDermott (Ph.D. Thesis) 1969 62 p
Avail: Univ. Microfilms Order No. 70-8763

Upper and lower bounds to the limit pressure for circular cylinders containing axial slits are obtained. Comparing these results with experimental data for steel and aluminum alloys, it is found that the information has a bearing on the brittle fracture problem. If fracture occurs at or above limit load, the occurrence is not serious; if fracture occurs below limit load, we have brittle fracture, which is extremely serious if the structure has been designed against plastic collapse. Materials which appear to be moderately ductile in simple tension may be brittle under combined stress (in this case 7075-T6 aluminum alloy) and slit cylinders under internal pressure may be suitable specimens for identifying such materials. Dissert. Abstr.

N71-26319 Brown Univ., Providence, R.I.
LONGITUDINAL WAVE PROPAGATION IN RODS WITH INTERFACES AND RODS OF NONUNIFORM CROSS SECTION
Amnon Meer (Ph.D. Thesis) 1969 221 p
Avail: Univ. Microfilms Order No. 70-8764

Wave propagation in elastic and linearly viscoelastic rods is discussed. An experimental technique is described, by which some basic properties of viscoelastic materials such as phase velocity, loss factor and stress relaxation function could be derived. The technique is based on the propagation and reflection of longitudinal stress pulses in a system of two bars, one of which is elastic with known properties, and the other viscoelastic with properties to be determined. The propagation of longitudinal stress waves in elastic and linearly viscoelastic bars of slowly varying cross-section, is treated by an elementary theory. Exact solutions based on this theory are presented for cones and exponentially variable cross-sections. Dissert. Abstr.

N71-26358 Brown Univ., Providence, R.I.
ON THE MICROMECHANISM OF BRITTLE FRACTURE PROPAGATION
Jiri Dvorak (Ph.D. Thesis) 1969 32 p
Avail: Univ. Microfilms Order No. 70-8711

This dissertation consists of two separate papers, "A Model of Brittle Fracture Propagation" and "Motion of Cracks in Brittle Fracture." The micromechanism of crack propagation in steel and similar metals is studied from the viewpoint of both material science and continuum mechanics. A continuum model which incorporates the two associated approaches is proposed and analyzed. The importance of grain orientation at conditions present at the tip of a moving crack is recognized and it is shown that two basic modes of material separation exist at the tip of a running brittle crack. Easy cleavage, or, propagation of cleavage microcracks which results in formation of a continuous, multiply connected, nearly planar path with a highly irregular front which spreads both forward and laterally through favorably oriented grains ahead of the crack tip. A description of motion of the crack zone is presented. While the main crack propagates, bursts of easy cleavage spread ahead, become arrested and reinitiated. This periodic process leads to stepwise propagation of the cleavage crack front and to velocity variation at the tip of the main crack. Dissert. Abstr.

N71-26359 Texas Technological Univ., Lubbock.
GENERAL INSTABILITY OF A CYLINDRICAL SHELL WITH CONICAL ENDS SUBJECT TO UNIFORM EXTERNAL PRESSURE
Sherrell Dane Manning (Ph.D. Thesis) 1969 189 p
Avail: Univ. Microfilms Order No. 70-12320

The elastic general instability problem of a hydrostatically loaded simply supported cylindrical shell with conical ends is discussed. The elastic general instability collapse mode is characterized by an overall asymmetric collapse of the cylindrical and conical portions together. A theoretical solution for the elastic general instability collapse pressure was formulated for a ring-stiffened cylindrical shell with conical ends. The shell was considered simply supported and hydrostatically loaded. Ring-stiffeners, at the junction of the cone and cylinder, were included in the solution formulation for additional generality. The solution was based on the classical small deflection theory of shells and the minimum potential energy criterion for stability. Dissert. Abstr.

N71-26368* # Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STRUCTURAL DESIGN AND STRESS ANALYSIS PROGRAM FOR ADVANCED COMPOSITE FILAMENT-WOUND AXISYMMETRIC PRESSURE VESSELS (COMTANK)
A. C. Knoell 1 Jun. 1971 31 p refs
(Contract NAS7-100)
(NASA-CR-118669; JPL-TR-32-1531) Avail: NTIS CSCL 13D

A computer program (COMTANK) that enables the user to design and analyze advanced composite filament-wound axisymmetric pressure vessels is presented. Based on user input, the program develops a pressure vessel design using netting analysis theory and then analyzes the design considering the orthotropic construction of the vessel. The analysis consists essentially of determining the stress resultants that exist at a point in the tank wall and then the stresses that exist in each ply of the laminate at that point. Author

N71-26369 Texas A&M Univ., College Station.
A CONSISTENT FIRST ORDER NONLINEAR SHELL THEORY
William Warren Boyd (Ph.D. Thesis) 1969 229 p
Avail: Univ. Microfilms Order No. 70-11530

A general nonlinear theory of shells is derived. The theory is valid for large extensions, shear and rotations. The large rotations of the shell are described in detail. The measures of bending deformation then are written explicitly in terms of these large rotations. The general nonlinear theory contains all of the existing approximate theories as special cases including a new first-order shell theory. The remaining portion of the dissertation consists of deriving the consistent first-order nonlinear shell theory from the general theory. The first-order approximation is obtained by consistently retaining only terms of the same order of magnitude as the squares and products of the shell reference surface displacements and their derivatives while discarding higher-order terms. Comparisons are made between the first-order equilibrium equations, the Mushtari-Galimov equations and the equations obtained by making the assumptions in Sanders' small strain-small rotation theory. The comparisons are made for shells of arbitrary geometry and a cylindrical shell. Dissert. Abstr.

N71-26421 Brown Univ., Providence, R.I.
A TECHNIQUE FOR APPROXIMATE SOLUTIONS OF IMPULSIVELY LOADED STRUCTURES OF A RATE SENSITIVE MATERIAL
Lester Sie-San Lee (Ph.D. Thesis) 1969 61 p
Avail: Univ. Microfilms Order No. 70-8750

A definition of a stationary mode for impulsively loaded structures of rate sensitive materials is derived based on a physical criterion. For some materials the stationary modes coincide with the natural modes. In rigid viscoplastic materials, where this is not the case, an approximate method referred to as the piecewise stationary mode approximation is suggested. In this approximate technique the velocity distribution at any instant is the stationary mode, and the variation with time is obtained from a necessary condition of equilibrium. For materials in which the natural and stationary modes coincide, the necessary condition is also a sufficient condition and the piecewise stationary mode solution is both kinematically and synamically admissible. Some physical insight and certain mathematical advantages are obtained by the piecewise stationary mode approximation when it is applied to rigid-viscoplastic problems, even though the solution is not necessarily dynamically admissible. Dissert. Abstr.

N71-26427 Virginia Polytechnic Inst., Blacksburg.
A STUDY OF ANISOTROPIC AND VISCOELASTIC DUCTILE FRACTURE
Henry Gonzalez, Jr. (Ph.D. Thesis) 1970 153 p
Avail: Univ. Microfilms Order No. 70-11506

Solutions are presented for ductile fracture of anisotropic static, orthotropic dynamic and anisotropic viscoelastic solids. The anisotropic static and orthotropic dynamic solutions were obtained by the complex variable approach. Stress functions which must satisfy a generalized bi-harmonic equation, are represented in terms of two analytic functions of two different complex variables. In this way boundary value problems can be reduced to problems of complex function theory. The anisotropic and dynamic solutions are thus seen to be completely analogous and thus similar relations are obtained for both cases. Dissert. Abstr.

N71-26467 California Inst. of Tech., Pasadena.
THE STATIC AND DYNAMIC STABILITY OF CLAMPED SHALLOW CIRCULAR ARCHES
Man-Cheong Cheung (Ph.D. Thesis) 1969 109 p
Avail: Univ. Microfilms Order No. 70-566

Concentrated static and step loads were applied to circular arches subjected to lateral forces. Equilibrium path and the dynamic response at the loading position were recorded. Dynamic buckling is distinct. Supercritical and subcritical responses were separated by 0.5% of the total load. The sensitivity of the arch to loading imperfection was studied. The effect was pronounced in the static tests but moderate in the dynamic responses. The motion of clamped circular arches under lateral impulse was recorded by a high speed camera and the deflected arch shape was measured in detail. The response was expressed in terms of the average displacement and three generalized displacement coordinates representing the amplitudes of the assumed mode shapes. The critical impulse is defined as the impulse level at the inflection point of the curve of maximum response versus impulse. Dissert. Abstr.

N71-26468 Texas A&M Univ., College Station.
TRANSVERSE EFFECTS IN THIN ELASTIC SHELLS
Thomas Edward Crippen (Ph.D. Thesis) 1969 81 p
Avail: Univ. Microfilms Order No. 70-11533

A shell theory is introduced which uses linearly exact expressions for the transverse variation of the displacement components. These displacement variations include separately the effects of transverse normal strain and transverse shear deformation. The shell theory is applied to a semi-infinite circular cylindrical shell with axisymmetric edge loading in order to investigate the significance of the transverse effects. The results of the study show that the inclusion of the transverse effects do not significantly alter the results of classical shell theory. However, the theory presents a means for determining the transverse strain distributions within the shell. Dissert. Abstr.

N71-26662# Naval Ordnance Lab., White Oak, Md.
FAILURE-DAMAGE ASSESSMENT TECHNIQUE FOR

HIGH-PRESSURE GAS CONTAINMENT VESSELS
Victor C. D. Dawson and Arnold E. Seigel 18 Sep. 1970 24 p refs
(AD-720686; NOLTR-70-208) Avail: NTIS CSCL 13/4

A necessary adjunct to the design of any high-pressure inert or explosive gas system is a failure-damage analysis wherein the gas storage system is assumed to rupture catastrophically and the resultant structural damage to the surroundings is assessed. This report describes the techniques that can be used to make a rapid preliminary damage assessment for such a case. Author (GRA)

N71-26680 Brown Univ., Providence, R.I.
ON THE APPROXIMATE SOLUTIONS OF IMPULSIVELY LOADED STRUCTURES, PART 1. SIMILARITY SOLUTIONS IN THE PROBLEM OF A RIGID VISCOPLASTIC ROD STRIKING A RIGID WALL, PART 2
Hwa-Shan Ho (Ph.D. Thesis) 1969 47 p
Avail: Univ. Microfilms Order No. 70-8735

By defining a dynamically admissible solution as one satisfying all governing relations except the initial conditions, the definiteness of convergence of such approximate solutions is established for stable dissipative materials, considering the possibility of the existence of a stationary or moving discontinuity interface. This is an extension of Martin-s uniqueness theorem for the same class of viscous materials, which includes for rigid-plastic and rigid-visoplastic idealizations. Methods of obtaining such dynamically admissible solutions for rigid-perfectly plastic materials are then discussed. Considered is a rod of rigid-viscoplastic material striking a rigid wall. The solution is for one-dimensional stress state where momentum conservation is achieved only over finite regions. Dissert. Abstr.

N71-26681* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ARBITRARILY SHAPED MODEL SURVEY SYSTEM Patent
Eugene C. Naumann and Bruce Flagge, inventors (to NASA) Issued 23 Feb. 1971 7 p Filed 23 Oct. 1967 Cl. 73-71.4; Int. Cl. G01d
(NASA-Case-LAR-10098; US-Patent-3,564,906; US-Patent-Appl-SN-677475) Avail: US Patent Office CSCL 13M

An apparatus for detecting and measuring structural deformations, either static or dynamic, of arbitrarily shaped models is reported. The apparatus includes a subsystem using feedback control to maintain a non-contacting deformation measuring sensor a predetermined distance from the model. A comparison subsystem compares the signal from the non-contacting deformation measuring sensor with a reference signal, and controls the polarity of the deflection analog signal. The analog signal is applied through an electronic amplifying and manipulating subsystem to an electronic display. In addition, apparatus is provided for moving the non-contact deformation measuring sensor over the surface of an arbitrarily shaped model.
Official Gazette of the U.S. Patent Office

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N71-25615# Fiat S.p.A., Turin (Italy). Div. Aviazione.
RELIABILITY ANALYSIS
Sep. 1970 41 p refs
(Contract ESTEC-CO/950/70)
(TASS-70-Y-0736) Avail: NTIS

A survey of the thermal stresses and onboard equipment reliability, and a reliability analysis of the action control system itself, employing louvers, are given. Some reliability prediction models of the active thermal control satellite are developed. ESRO

N71-25683*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF EXIT TEMPERATURE SAMPLING DENSITY ON MEASURED COMBUSTOR PERFORMANCE
Robert E. Jones Washington May 1971 8 p refs
(NASA-TN-D-6352; E-6185) Avail: NTIS CSCL 20M

An analysis of combustor exit temperatures obtained with traversing thermocouple probes was made to indicate what the effect on computed combustor parameters would be if the number of sampling points was decreased. A total of 585 readings in an area of 2500 sq cm were obtained with the traversing probes at the outlet of an annular combustor. The analysis indicates that a combustor temperature rise determined from approximately 150 of these readings would yield a sufficiently accurate value of combustion efficiency (within 1 percent in the case of combustors having reasonable outlet temperature uniformity). However, a reasonable measure of the combustor exit temperature pattern factor requires in excess of 400 thermocouple readings. Author

N71-25697# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
CONCEPTUAL STUDY ON MOVABLE LOUVER SYSTEMS FOR SATELLITE THERMAL CONTROL IN SOLAR ENVIRONMENT
K. Moritz, H. Herbst, and H. Maier 28 Sep. 1970 244 p refs
(Contract ESTEC-894/69HP)
Avail: NTIS

The basic design concept of louvers is to vary the position of radiation shields (blades) which are arranged over the satellite surface (base), by an actuation mechanism, so that the base temperature will be constant under any internal or external thermal load condition. All problems related to mechanical and thermal design, as well as to development, manufacturing, system reliability, and qualification, are discussed. ESRO

N71-25698# Fiat S.p.A., Turin (Italy). Div. Aviazione.
SURVEY AND APPLICATION STUDIES Summary Report
Sep. 1970 83 p refs
(Contract ESTEC-CO/950/70)
(TASS-70-Y-0683; TASS-70-Y-0716) Avail: NTIS

After a survey of the possibilities for active thermal control systems for satellites, the application of louvers on existing spacecraft is reviewed. ESRO

N71-25699# Fiat S.p.A., Turin (Italy). Div. Aviazione.
THERMAL STUDIES
Sep. 1970 91 p refs
(Contract ESTEC-CO/950/70)
(TASS-70-Y-0719) Avail: NTIS

By using thermal models, a louver array for satellite thermal control is analyzed in sunlight and shadow operation. The purpose of these studies is to evaluate the importance of the main design thermal parameters by means of a series of calculations. ESRO

N71-25718*# Translation Consultants, Ltd., Arlington, Va.
SIMPLIFIED THERMODYNAMIC TREATMENT OF EQUILIBRIUM AND NONEQUILIBRIUM CONDITIONS IN PHYSICAL CHEMISTRY [VEREINFACHTE THERMODYNAMISCHE BEHANDLUNG VON GLEICHGEWICHTS- UND NICHTGLEICHGEWICHTSZUSTAENDEN IN DER PHYSIKALISCHEN CHEMIE]
G. Job (Ph.D. Thesis—Hamburg Univ., 1958) Washington NASA

May 1971 40 p refs Transl. into ENGLISH of Hamburg Univ. thesis
(Contract NASw-2038)
(NASA-TT-F-13649) Avail: NTIS CSCL 20M

By a suitable choice of partly known, partly new, often trivial rules for the identical transformation of differential expressions, the number of thermodynamic calculations can be reduced, and the result of many problems can be condensed into one line. All the reciprocity relations of classical thermodynamics and of the thermodynamics of irreversible processes can be obtained in one single calculation step. Author

N71-25781# Fiat S.p.A., Turin (Italy). Div. Aviazione.
MECHANICAL AND STRUCTURAL STUDIES
Sep. 1970 83 p refs
(Contract ESTEC-CO/950/70)
(TASS-70-Y-0731) Avail: NTIS

Problems connected with the choice of the actuators, the actuation mechanisms, and the bearings suitable to be employed on a louver array satellite thermal control system are analyzed. Some structural solutions for the blades are studied, analyzed, and developed. ESRO

N71-25788*# Techtran Corp., Glen Burnie, Md.
NONLINEAR HEAT CONDUCTION PROBLEM AT BOUNDARY CONDITIONS OF THE FOURTH KIND [NELINEYNAYA ZADACHA TEPLOPROVODNOSTI PRI GRANICHNYKH USLOVIYAKH CHETVERTOGO RODA]
I. V. Travnitskaya et al Washington NASA May 1971 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk BSSR (Minsk), v. 14, no. 9, 1970 p 808–811
(Contract NASw-2037)
(NASA-TT-F-13663) Avail: NTIS CSCL 20M

The small parameter method is used to analyze the temperature distribution for two rods in contact with boundary conditions of the fourth kind. Author

N71-25789# Lockheed Missiles and Space Co., Palo Alto, Calif.
THERMAL ANALYSIS OF BUILT-IN HEAT EXCHANGERS
A. D. Suslov 4 Apr. 1969 5 p Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostro. (Moscow), no. 2, 1971 p 75–78
Avail: NTIS: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Specific peculiarities of the progress of processes in built-in heat exchangers are examined. Simplified dependences are obtained which are acceptable for the analysis of machines with low and medium values of the cold production. Author

N71-25790# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON IGNITION LIMITS IN A RADIATION FIELD
A. N. Oraevskii [1971] 4 p refs Transl. into ENGLISH from Khim. Vys. Energ. (USSR), v. 5, no. 2, 1971 p 118–120
Avail: NTIS: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The influence of radiation on the limits of a thermal explosion are discussed. Radiation acting on a system with a population inversion of the energy levels tends to equilibrate their population by means of induced transitions. Part of the energy being liberated during the reaction can hence be extracted from the system because of amplification of the radiation acting on the reacting mixture. And this means that the effect of the radiation can retard the development of the reaction. Deceleration of the reaction can be both purely thermal and can occur due to a change in kinetics because of the different reactivities of the excited and unexcited reaction products. In particular, this can be felt strongly in the energy bifurcation of the reaction. Author

N71-25801*# Rocketdyne, Canoga Park, Calif.
SPACE STORABLE REGENERATIVE COOLING INVESTIGATION Final Report, Jul. 1967–May 1970
R. P. Pauckert Jun. 1970 351 p refs
(Contract NAS3-11191)
(NASA-CR-72705; R-8266) Avail: NTIS HC $6.00/MF $0.95 CSCL 20M

Analyses were conducted to determine the regenerative cooling limits of the light hydrocarbons with FLOX and OF2 over a wide range of operating conditions. Methane was shown to be the most attractive fuel. Performance and heat transfer characteristics were experimentally determined for triplet and concentric element injectors at chamber pressures of 500 to 900 psia and propellant mixture ratios of 3.5 to 7.6 using water-cooled hardware. Both injectors performed well with the concentric injector producing lower heat fluxes in the combustion zone. A regeneratively cooled thrust chamber with a 60:1 expansion area ratio nozzle was fabricated using an electroforming fabrication technique. The chamber was operated from 500 to 640 psia and mixture ratios of 2.8 to 5.7. Other concentric element injectors were tested in water-cooled and regeneratively cooled thrust chambers at pressures as low as 46 psia to demonstrate throttling capability. Author

N71-25805# Massachusetts Inst. of Tech., Cambridge. Engineering Projects Lab.
SUBCOOLED FLOW BOILING OF FLUOROCARBONS
Richard W. Murphy and Arthur E. Bergles Jan. 1971 185 p refs Prepared for IBM, Poughkeepsie, N.Y.
(DSR-71903-72) Avail: NTIS

Heat transfer and hydrodynamic behavior for subcooled flow boiling of Freon-113, one of a group of fluorocarbons suitable for use in cooling of high power density electronic components are studied. Problems arising from the excellent wetting characteristics and large solubility constants of fluorocarbons were also examined. Data in the fully developed boiling mode were successfully described by modifications of existing correlations. Models and analyses were formulated for predicting delayed nucleation and dissolved gas effects on incipience. Delayed nucleation and hysteresis were successfully eliminated by means of a special surface coating. Transition in gassy boiling heat transfer from gas dominated to vapor dominated modes was postulated with reference to adjusted saturation temperatures. Single phase pressure drop was adequately correlated by standard methods. Parametric effects on two phase total pressure drop were investigated and described. Three techniques--photographic, trap, and capacitance were employed to obtain accurate void fraction measurements. A qualitative description of the gas dominated to vapor dominated transition in pressure drop performance, analogous to that for heat transfer, was developed. Author

N71-25812*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MATHEMATICAL ANALYSIS OF A VUILLEUMIER REFRIGERATOR
Allan Sherman Mar. 1971 39 p refs
(NASA-TM-X-65534; X-763-71-125) Avail: NTIS CSCL 20M

A comprehensive analysis of the Vuilleumier refrigerator was conducted. This analysis includes the effects of non-isothermal gas heat addition and rejection, hot and cold regenerator inefficiencies, conduction losses, and gas leakage losses. A computer program was written which solves the equations resulting from the analysis. The program calculates internal pressures, temperatures, and gas flow rates as functions of refrigerator crank angle, as well as overall refrigerator cooling load and power input. Comparisons between the program results and available data show good agreement, with a marked improvement over the predictions of the ideal model. Author

N71-25902*# Kentucky Univ., Lexington. Coll. of Engineering.
THE SIMILARITY OF BUBBLE GROWTH IN BOILING AND

ELECTROLYSIS
Amit Bhattacharya, John H. Lienhard, and James E. Funk May 1970 39 p refs
(Grant NGR-18-001-035; Contract DAAB07-69-C-0366)
(NASA-CR-118641; AD-707432; TR-23-70-ME-7) Avail: NTIS CSCL 20M

The overall objective of the study is to determine the conditions under which electrolysis and nucleate boiling will prove to be similar processes. Author (GRA)

N71-25952# Utah Univ., Salt Lake City. Coll. of Engineering.
THE CHEMISTRY AND MECHANICS OF COMBUSTION WITH APPLICATION TO ROCKET ENGINE SYSTEMS Annual Progress Report, 1 Sep. 1969 -31 Aug. 1970
A. D. Baer, N. W. Ryan, L. K. Isaacson, J. D. Seader, and R. W. Grow Nov. 1970 187 p refs
(Contract F44620-68-C-0022; Proj. Themis)
(AD-720834; THEMIS-UTEC-TH-70-204; AFOSR-TR-71-0623) Avail: NTIS CSCL 21/9

The document is concerned with a consolidated and integrated series of investigations in the general area of combustion and combustion related research. Several specific studies, which have the molecular morphology as the common thread affecting both the combustion and mechanical behavior, have been initiated. The present report presents a series of papers representing the results of quite recent work. Author (GRA)

N71-25963*# Kentucky Univ., Lexington. Boiling and Phase Change Lab.
GRAVITY BOILING STUDIES Final Report, 1 Sep. 1969 -31 Dec. 1970
John H. Lienhard May 1971 10 p refs
(Grant NGR-18-001-035)
(NASA-CR-118638) Avail: NTIS CSCL 20M

Research progress on the interacting effect of gravity and size upon the peak and minimum pool boiling heat fluxes is reported. The objectives of the work discussed were: (1) to learn what mechanisms dictate boiling heat fluxes in the near-zero-gravity range, and to develop predictive equations for the specific case of small cylindrical heaters; (2) to determine whether there might be significant direct effects of viscosity on the extreme boiling heat flux; and (3) to determine the analogy between boiling and electrolysis. F.O.S.

N71-26004# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
TIME-RESOLVED MEASUREMENTS OF HYDROCARBON MASS FLOWRATE IN THE EXHAUST OF A SPARK-IGNITION ENGINE
Rodney J. Tabaczynski, John B. Heywood, and James C. Keck Apr. 1971 32 p refs Sponsored in part by PHS Special Air Pollution Fellowship *Its* Fluid Mech. Lab. Publ. No. 71-10
(Grant NSF GK-15409)
Avail: Issuing Activity

Experimental measurements of the instantaneous exhaust gas temperature, mass flow rate, and hydrocarbon concentration were made in the exhaust of a single cylinder research engine. The temperature measurements were accomplished using an infrared optical technique and observing the radiation of the exhaust gas at the 4.4 micrometers band of CO2. Instantaneous exhaust gas mass flow rates were monitored by placing a restriction in the exhaust manifold and measuring the instantaneous pressures across the restriction. Time resolved hydrocarbon concentrations were measured using a fast acting sampling valve with an open time of 2 milliseconds. From these measurements the hydrocarbon mass flowrate is calculated as a function of crank angle. The hydrocarbon mass flowrate calculations show that approximately 40 percent of the hydrocarbons leave the cylinder early in the exhaust process due to the exit of the head quench layer, and 50 percent leave the cylinder near the end of the exhaust process due to the exit of a hydrocarbon rich vortex produced by the upward motion of the piston. The remainder of the hydrocarbons leave in the middle of the exhaust stroke. Author

N71-26021# Naval Ordnance Station, Indian Head, Md.
ON SOME PHYSICAL PROPERTIES OF FLAMES. PART 2: THE STATIC AND OSCILLATORY SOLUTIONS OF THE FLAME EQUATIONS Technical Report, 1 Jul. 1969 - 30 Jun. 1970
Alfonso Campolattaro and Ottmar H. Dengel 30 Sep. 1970 24 p refs
(AD-719892; NOS-IHTR-327-Pt-2) Avail: NTIS CSCL 21/2

The analysis of the static solutions shows that the determination of the concentration of negative ions in a flame can be used as a method for checking if a flame has reached the static configuration. This follows from the fact that the concentration of negative ions must be zero for a flame in static state, which means that the only process occurring in a static-state flame is that process which is present in a condition of thermal equilibrium and which is described by Saha's equation. Therefore, any deviation from Saha's equation corresponds to a nonstatic configuration or to the presence of another microprocess not included in the six processes assumed in the present theory. The discussion of the oscillatory solution permits the enunciation of the necessary and sufficient condition for a flame to exhibit an oscillatory configuration and the determination of the frequency of oscillation for each flame species at any point of the flame. The oscillatory solution suggests that a flame can be regarded as a gas of harmonic oscillators. The electrons are the only components to be considered which interact with an electromagnetic field, as a gas of harmonic oscillators. A theoretical upper limit for the eigen-frequencies in flames has been given; a numerical evaluation of those frequencies is in progress. Author (GRA)

N71-26034*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYSIS OF THE THERMAL RESPONSE OF HIGH DENSITY PHENOLIC NYLON ON A SPACECRAFT LAUNCHED BY THE PACEMAKER VEHICLE SYSTEM
William G. Witte Washington May 1971 42 p refs
(NASA-TN-D-6293; L-7230) Avail: NTIS CSCL 20M

The thermal response of high density phenolic-nylon material was determined by a flight test of a recoverable spacecraft. Ablation performance data on the phenolic-nylon were obtained by the use of ablation sensors and thermocouples and by postflight profile-change measurements. A comparison of the flight test data with predictions based on the Stanford Research Institute correlation is reported. Comparisons of the flight test data with oxidation-theory predictions are also presented. The measurements obtained from the ablation sensors and thermocouples used on the spacecraft are discussed. Author

N71-26035*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NUMERICAL ANALYSIS OF THE TRANSIENT RESPONSE OF ABLATING AXISYMMETRIC BODIES INCLUDING THE EFFECTS OF SHAPE CHANGE
Stephen S. Tompkins, James N. Moss, Claud M. Pittman, and Lona M. Howser Washington May 1971 44 p refs
(NASA-TN-D-6220; L-7474) Avail: NTIS CSCL 20M

The differential equations governing the transient response of an ablating axisymmetric, orthotropic body have been derived for fixed points in a moving coordinate system. These equations have been expanded into finite difference form and programed for numerical solution, with an implicit technique, on a digital computer. Numerical results compare favorably with exact solutions. Several applications of the analysis are discussed. These applications

demonstrate the significance of a salient feature of the analysis, that is, the ability to analyze the effects of changes in body geometry. This feature was used to obtain satisfactory agreement between numerical and experimental results for an ablating teflon sphere and a small test specimen exposed to a high-intensity laser beam. Although the analysis is primarily for a single-layer material, a multilayer material can be successfully approximated under certain conditions by a single-layer system. Author

N71-26054*# McDonnell-Douglas Co., St. Louis, Mo.
AN ANALYSIS OF PREDICTED SPACE SHUTTLE TEMPERATURES AND THEIR IMPACT ON THERMAL PROTECTION SYSTEMS
R. V. Masek and J. Alan Forney (NASA. Marshall Space Flight Center) *In* NASA, Washington NASA Space Shuttle Technol. Conf., Vol. 1 Apr. 1971 p 75–96 (See N71-26051 14-31)
Avail: NTIS HC$9.00/MF$0.95 CSCL 20M

Aeroheating prediction methods for the space shuttle configuration are evaluated by comparing evolved time-temperature histories computed at five lower centerline locations for various combinations of flow field method, transition criterium, turbulent heating method and trajectory analysis. Considered are a metallic heat shield and a surface insulation concept, low and high cross-range missions, and a conical flow field with normal shock expansion to Newtonian pressure. The low cross-range mission peak temperature was found to be most sensitive to flow field assumption and the high cross-range mission was most affected by transition criteria. A conical flow assumption produces temperatures 166 C - 222 C higher than the normal shock assumption; the effects of transition criteria are noticeable about 111 C. For the low cross-range mission, the thermal protection system unit weight for one aeroheating methodology proved 32.1 N/sq m lighter than for another prediction method. G.G.

N71-26057*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SHOCK INTERFERENCE HEATING AND DENSITY-RATIO EFFECTS. PART 1: FLOW FIELD VISUALIZATION, THERMOCOUPLE MEASUREMENTS, AND ANALYSIS
H. Lee Seegmiller *In its* NASA Space Shuttle Technol. Conf., Vol. 1 Apr. 1971 p 185–215 ref (See N71-26051 14-31)
Avail: NTIS HC$9.00/MF$0.95 CSCL 20M

Flow field visualization techniques, thermocouple measurements, and analyses of shock interference phenomena about a model of the straight wing orbiter established: (1) wing fuselage shock interference heating effects for low sweep wing at angles of attack from 20 deg to 70 deg; (2) stagnation region and shock boundary layer interference effects at small angles of attack; (3) stagnation region interference effects only at large angles of attack; (4) suitability of the local angle of attack theory for predicting stagnation region interference effects provided the stagnation streamline is known; (5) significant wing root interference effects; and (6) peak interference temperature similarities at Mach = 7.4, Re = 1.10 times 1 million and at Mach = 15, Re = 0.03 times 1 million. G.G

N71-26058*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SHOCK INTERFERENCE HEATING AND DENSITY RATIO EFFECTS. PART 2: HYPERSONIC DENSITY RATIO EFFECTS
James L. Hunt and Theodore R. Creel, Jr. *In* NASA Space Shuttle Technol. Conf., Vol. 1 Apr. 1971 p 217–243 (See N71-26051 14-31)
Avail: NTIS HC$9.00/MF$0.95 CSCL 20M

Ground test data obtained at hypersonic Mach numbers and at various values of specific heat-gas ratios are used to simulate the trends of equilibrium real gas effects expected for low cross-range shuttle flight. Applied are data on shock shape, surface oil flow patterns, and for the location of the body shock/wing shock intersection location obtained at various angles of attack and with normal shock density ratios of 3.9, 5.6, and 12, respectively. Primary conclusions show that significant shock-density-ratio effects are strongly configuration and angle-of-attack dependent and that a high cross-range shuttle configuration which reenters at lower angles of attack is essentially a best choice. G.G.

N71-26059*# General Dynamics/Convair, San Diego, Calif. Aerospace Div.
SHOCK INTERFERENCE HEATING ON THE SPACE SHUTTLE BOOSTER DURING ASCENT
O. Brevig and C. Young *In* NASA, Washington NASA Space Shuttle Technol. Conf., Vol. 1 Apr. 1971 p 245–268 (See N71-26051 14-31)
Avail: NTIS HC$9.00/MF$0.95 CSCL 20M

Paint phase-change and thermocouple test results from space shuttle booster ascent wind tunnel simulations show that: (1) interference heating on the booster top surface is caused by shock impingement due to orbiter and booster bow shocks in the gap region; (2) interference heating in the gap region increases with free stream Mach number; (3) a reasonable correlation between paint phase-change and thermocouple heat transfer rate test data is obtained; and (4) paint phase-change test data cannot be used accurately to measure peak heat transfer rates in areas of highly localized heating due to shock impingement. G.G.

N71-26060*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LEE SIDE HEATING INVESTIGATIONS. PART 1: EXPERIMENTAL LEE SIDE HEATING STUDIES ON A DELTA WING ORBITER
Jerry N. Hefner and Allen H. Whitehead, Jr. *In its* NASA Space Shuttle Technol. Conf., Vol. 1 Apr. 1971 p 267–287 refs (See N71-26051 14-31)
Avail: NTIS HC$9.00/MF$0.95 CSCL 20M

The effects of Reynolds number and angle of attack on the magnitude and distribution of lee surface heating at Mach 6 on a delta wing orbiter establish that: (1) the growths of lateral body dimensions in addition to nose shape and bluntness have a strong influence on the nature of vortical flow and leeside heat transfer; and (2) the flow about a cylindrical body is essentially two dimensional at the 55 deg angle of attack with reference to the body axis. G.G.

N71-26061*# Grumman Aerospace Corp., Bethpage, N.Y.
LEE SIDE HEATING INVESTIGATIONS. PART 2: LEE SIDE HEATING INVESTIGATIONS OF SIMPLE BODY LIKE CONFIGURATIONS
George Maise *In* NASA, Washington NASA Space Shuttle Technol. Conf., Vol. 1 Apr. 1971 p 289–309 refs (See N71-26051 14-31)
Avail: NTIS HC$9.00/MF$0.95 CSCL 20M

The leeside aerodynamic heating of various shapes flying hypersonically at an angle of attack was investigated. Intense heating resulting from reattachment of leading-edge vortices on the lee side of the bodies was analyzed by: (1) correlation and comparison of available leeside heating data, and (2) an experimental program to clarify some questions related to the vortical flow phenomenon. In the correlation of available data on circular cones, a strong Reynolds number dependence has been observed. In the wind tunnel study, the effect of increase in cross sectional area on vortical heating was examined, and an attempt was made to establish the angles of attack at which the flow about elongated bodies becomes two dimensional in the cross-flow plane, i.e., negligible axial components. Heat transfer and oil flow models were tested in a hypersonic wind tunnel. Author

N71-26084*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PLUME IMPINGEMENT DURING SEPARATION OF A TWO STAGE SPACE SHUTTLE VEHICLE
Ivy Fossler and Robert Prozen (Lockheed Missiles and Space Co., Huntsville, Ala.) *In its* NASA Space Shuttle Technol. Conf., Vol. 1 Apr. 1971 p 393–421 refs (See N71-26051 14-31)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20M

Plume impingement effects are assessed in optimum separation trajectory analysis for a two stage space shuttle configuration. The optimum trajectory provides an acceptable tradeoff between the effect on vehicle design necessary to withstand the plume impingement environment with resultant penalties in performance. Thrust-buildup-time history effects on the trajectory and the magnitude of the plume impingement forces, moments, and heating rates are considered during separation. Results indicate that several plume problem areas identified, while significant, are not detrimental to the separation maneuver if the orbiter and booster are separated at, or before, the time that the orbiter engines acquire a 20 percent thrust level. G.G.

N71-26095# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INTENSITY OF TURBULENCE BEHIND ORTHOGONAL GRIDS
V. K. Zotin et al 21 Dec. 1970 14 p refs Transl. into ENGLSIH from Aviats. Inst., Tr. (Kazan), no. 93, 1967 p 17–24
(AD-720756; FTD-MT-24-265-70) Avail: NTIS CSCL 21/2

The article describes a method developed to investigate turbulence intensity behind a turbulence-forming grid. The optical diffusion method was used. In this method the cross section of tongues of smoke are recorded on photographic films. An experimental device used in the conduct of the investigation is described. Author (GRA)

N71-26242 Wisconsin Univ., Madison.
INVARIANCE CONCEPTS IN THERMAL MECHANICS
William Burton Scholten (Ph.D. Thesis) 1970 370 p
Avail: Univ. Microfilms Order No. 70-8330

A thermodynamic theory was studied which could serve as a basis for deducting governing equations for nonequilibrium continuum processes that are adequately covered by conventional thermodynamics. Such equations would have practical impact in such diverse areas as chemical reaction kinetics, metastable flows, viscoelastic deformations, etc. The governing equations developed are systems including partial differential equations and other complementary equations. The similarity method for solving such systems has many basic features in common with tensor analysis. Therefore, a study of the similarity method was pursued, which lead to improvements in the formalism for applying similarity theory. Dissert. Abstr.

N71-26254 Missouri Univ., Rolla.
A STUDY OF THE EFFECT OF TUBE BUNDLE GEOMETRY ON THE NUCLEATE BOILING REGION OF A SERIES OF HYDROCARBON LIQUIDS
Robert Terry Montgomery (Ph.D. Thesis) 1969 200 p
Avail: Univ. Microfilms Order No. 70-11763

Tube bundle geometry effects on nucleate boiling region of a tube whose single tube boiling characteristics are known are discussed. A series of tests were conducted with horizontal tube bundles which produced boiling in a saturated pool of n-hexane, n-pentane, and a seven carbon (C7) hydrocarbon mixture at atmospheric pressure. Tube bundle size and pitch were the principle independent variables considered. The phenomena of heater hysteresis and aging were also studied. Data are presented which indicates that aging probably is not a direct consequence of gas adsorption on the surface. The tube bundle data showed that the most transfer coefficients for the individual heaters in the bundle were larger than the coefficients for the same heaters in single tube tests particularly in the lower portion of the nucleate boiling region. Dissert. Abstr.

N71-26264 Texas A&M Univ., College Station.
A DIFFERENTIAL REGIONAL BWR MODEL EQUATION OF STATE WITH APPLICATION TO GASEOUS ETHANE AND LIQUID METHANE
Ben Franklin Fort, Jr. (Ph.D. Thesis) 1969 148 p
Avail: Univ. Microfilms Order No. 70-11537

A differential, regional BWR model for prediction of volumetric properties in the fluid state is developed. This model allows the breakdown of PVT data into various regions with assurance of required continuity across the data region interfaces. The method is applied to available data on superheated ethane and liquid methane. Coefficients are found for the model and used to compare against experimental data and the results of previous data representations. The coefficients found are utilized to compute thermodynamic properties. Computed thermodynamic properties are compared with previous results from different investigations. Dissert. Abstr.

N71-26285 Denver Univ., Colo.
A STUDY OF THE IGNITION OF COMPOUND POROUS PARTICLES WITH MULTISTAGE REACTIONS
Franklin Ivan Hones (Ph.D. Thesis) 1969 180 p
Avail: Univ. Microfilms Order No. 70-11923

Analytical methods to predict the ignition performance of compound porous particles with multistage reactions are developed. Hypothetical composite models to explain the steps in the ignition of two basically different types of compound porous materials: (1) the light metal hydrides and (2) cellulosic materials are presented. A digital computer program (PARTIG) has been developed based on these models. This program includes heat transfer, mass transfer and reaction kinetics and predicts the temperatures and mass concentrations within the particle as a function of time as well as the amount of material pyrolized and an estimate of the flame radius for the pyrolysis of volatile gases prior to final ignition and combustion. Dissert. Abstr.

N71-26329 Denver Univ., Colo.
TRANSIENT DETONATION PHENOMENA IN PULSED ROCKET ENGINES
William Harvey McLain (Ph.D. Thesis) 1969 260 p
Avail: Univ. Microfilms Order No. 70-11927

Pulse-mode rocket engines using nitrogen tetroxide/hydrazine propellants undergo occasional structural failure caused by high pressure spiking when operated under high altitude startup conditions. Analytical and experimental results indicate that the most probable mechanism causing this failure is the development of chemically reactive gaseous hot spots within the propellant residues formed during pulse-mode engine operation. These hot spots are formed by an adiabatic compression during the preignition phase of operation and may contribute sufficient energy to the hydrazinium nitrate residues to cause explosive initiation following the propulsive chemical reaction process. Theoretical thermochemical calculations are used to predict species that are formed under equilibrium conditions. These calculations cover a wide range of oxidant/fuel mixture ratios, and they are used both to establish engine design criteria and to provide a theoretical estimate of relative species concentrations under the assumption of equilibrium reaction conditions. Dissert. Abstr.

N71-26332 Princeton Univ., N.J.
RADIATIVE IGNITION OF POLYMERIC FUELS IN AN OXIDIZING GAS
Thomas Joseph Ohlemiller (Ph.D. Thesis) 1969 190 p
Avail: Univ. Microfilms Order No. 70-11943

A radiative ignition apparatus based on the use of a high

power, continuous wave, CO2 laser has been developed and employed to examine the effects of radiant flux, pressure, oxygen concentration, and absorptivity on the ignition delay of polystyrene and an epoxy polymer in oxygen/nitrogen mixtures. The general observed behavior is rationalized within the context of a gas phase ignition mechanism. Quantitative comparison of the results on the effects of flux and absorptivity with the predictions of the approximate solution reveals that this solution predicts the trends quite well but predicts too short an ignition delay if the fuel is assumed to ignite rapidly after attaining its bulk degradation temperature. Dissert. Abstr.

N71-26353# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

HEAT TRANSFER DURING THE CONDENSATION OF VAPOR IN A TUBE

L. D. Boiko et al 1971 25 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Izv. Energ. i Transp. (Moscow), no. 5, 1966 p 113–128
(AD-720058) Avail: NTIS CSCL 20/13

The work sets forth an approximated theoretical calculation of heat transfer during the condensation of vapor in a tube based on the analogy between the hydraulic friction resistance and heat exchange according to Reynolds. A review of the works by other authors on the subject mentioned is given. The work also sets forth the experimental data obtained during vapor condensation within tubes with a diameter of up to 18 mm, a length of up to 12 meters at pressures of up to 90 bars. In the case mentioned the calculated results and experimental data on heat transfer agree. Author (GRA)

N71-26356# Reactor Group, United Kingdom Atomic Energy Authority, Sellafield (England).

BOWING OF A HEATED ELEMENT COOLED BY FORCED CONVECTION

A. C. Rapier 1970 24 p refs
(TRG-REPORT-1915) Avail: AEC Depository Libraries; HMSO 3s 6d; BIS $0.70

When unsymmetrical conditions exist around a heated element cooled by flow in a channel, there will be temperature variations around its circumference. This will result in a tendency for the hottest side of the element to bow away from its normal axis. Usually a movement in this direction results in a reduction of the heat transfer coefficient and an increase in the local coolant temperature on the hot side, inducing greater temperature differences around the element and further movement. Under some conditions this can lead to complete instability. This problem was previously examined for the case of an element simply supported at each end with reference to fuel elements for nuclear reactors. The generality of previous solutions is extended to cover any channel shape and any number of spans. Explicit functions are derived for the final shape of the element, the temperature distribution along it and the forces on the supports. Author (NSA)

N71-26357 North Carolina State Univ., Raleigh.

HEAT CONDUCTION WITH PHASE CHANGES

Sung Hwan Cho (Ph.D. Thesis) 1969 74 p
Avail: Univ. Microfilms Order No. 70-12821

One-dimensional nonlinear heat conduction problems involving phase changes are studied. Approximate solutions are obtained for the temperature distributions and phase change positions when the phase change is caused by constant heating (or cooling) or convection to a constant temperature surrounding. The initial temperature is assumed to be the fusion temperature. Two methods of approximation, the temperature approximation and the heat flux approximation, are developed. In the temperature approximation, the temperature distribution is assumed to be similar to the temperature profile without phase change for the similar surface conditions. In the heat flux approximation, the heat flux function is defined and approximate solutions are obtained such that the energy equation is satisfied by the heat flux function but not necessarily by the temperature distribution. Dissert. Abstr.

N71-26364*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

THERMAL MEASUREMENTS

In its Sixth Transducer Workshop 1969 p 3–18 refs Conf. held at Hampton, Va. 22–24 Oct. 1969; sponsored by NASA
(See N71-26363 14-14)
Avail: NTIS CSCL 20M

The measurement method of high temperatures in rocket nozzle ablative materials was developed and successfully demonstrated. The technique is based on the use of implanted microcapsules containing metal-carbon or carbide-carbon compositions which undergo distinctive and irreversible changes upon reaching their respective melting points. Fifteen different compositions are used to span the range from 3150 F to 6233 F and to provide accurate indications of temperatures attained at a point. The theory of operation of the technique is presented, together with a description of the instrument's design and characteristics. Author

N71-26440*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

THERMAL ANALYSIS SYSTEM 1: USER'S MANUAL

J. A. Hultberg and P. F. O'Brien 1 Mar. 1971 65 p refs
(Contract NAS7-100)
(NASA-CR-118649; JPL-TR-32-1416) Avail: NTIS CSCL 20M

A computer program (Thermal Analysis System I) was written to calculate steady-state temperatures for a radiation-conduction-coupled constant-property thermal model. A two-region spectral analysis is provided for the radiation portion of the computation. The script F technique is used for infrared heat transfer and the radiosity technique is used for solar heat input. The program is designed for maximum ease of use from the user's standpoint. The rules for order and placement of user input data to the program are almost free-form. The output is formatted for ease of user understanding and diagnosis of errors. Some user control of output is provided. Author

N71-26469 Massachusetts Univ., Amherst.

EFFECTIVE THERMAL CONDUCTIVITY OF COMPOSITE SOLIDS

Thomas P. Fidelle, Jr. (Ph.D. Thesis) 1969 82 p
Avail: Univ. Microfilms Order No. 70-13208

Experimental studies were made of the effects of composition, particle size, and pure-component thermal properties on the effective thermal conductivity of three different composite systems. Cylindrical samples of each system were cast from various proportions of their basic constituents. Effective thermal conductivities were calculated from effective thermal diffusivities. The latter were obtained experimentally from the thermal response of the center of each composite sample as it was cooled from room temperature to 0 C by means of an agitated ice bath. Effective conductivities so obtained were compared with conductivities predicted by the tridirectional simulation and three previously-published models. Results show that a recent model that utilizes unidirectional heat flux but permits random phase distribution provides the best predictions of the experimental data presented in this work. Dissert. Abstr.

N71-26488# General Electric Co., Schenectady, N.Y. Research and Development Center.

TEMPERATURE MEASUREMENT BY THERMAL NOISE AT HIGH PRESSURES

R. H. Wentorf, Jr. *In* NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 81–89 refs (See N71-26476 14-12)
Avail: SOD $4.50

The temperature of a small carbon resistor (700 to 3,000 ohms) in a high pressure cell next to a Pt-Pt10 percent Rh thermocouple was measured by thermal noise. Runs were made at 40 and 50 kbar to temperatures of about 1,400 K. The results suggest that at the highest temperatures the thermocouple indicated temperatures from 40 to 60 K too low, in fairly good agreement with estimates made by other methods. Author

N71-28483# Stanford Research Inst., Menlo Park, Calif.
SHOCK TEMPERATURE CALCULATIONS FOR SILICONE FLUID
M. Cowperthwaite and J. H. Blackburn /n NBS Accurate Characterization of the High Pressure Environment Mar. 1971 p 137–145 refs (See N71-26478 14-12)
(Contract DA-18-035-AMC-122(A))
Avail: SOD $4.50

The problem of calculating shock temperature indirectly from experimental data without assuming thermodynamic properties is formulated and solved theoretically. Experiments were performed in an attempt to construct equations of state for silicone fluid 210. Shock and free surface velocities were measured to determine Hugoniot curves in the 300 kbar regime, and energies and densities were measured from −30 to +260 C along the atmospheric isobar to determine the initial states of the shock wave experiments. It was necessary to assume a form for the (e−p−v) equation of state, since the differences in volumes between states on Hugoniot curves at the same pressure above 40 kbar were found to be comparable with the experimental error in measuring the volumes of each of these states. The data were fitted to a Mie-Gruneisen type (e−p−v) equation of state and shock temperatures on the 25 C hugoniot were calculated at points of intersection with isentropes. The position of the 296 C isentrope limits the temperature calculation with isentropes to values below 522 C and 58 kbar, and the values around 50 kbar are 8 percent lower than those calculated with the 25 C value of C sub v, since C sub v increases along the Hugoniot curve. Temperature calculations above 58 kbar assumed the 296 C value of C sub v. Author

N71-28682# Du Pont de Nemours (E. I.) and Co., Richmond, Va. Spruance Film Research and Development Lab.
THERMODYNAMICS OF ADHESION OF POLYMER DISPERSIONS TO FILMS
Muhammad S. Sahli [1970] 25 p refs Presented at the Gordon Res. Conf., Adhesion Div., 27 Aug. 1970 Submitted for publication
Avail: NTIS

The principles of thermodynamics are used to analyze adhesion problems related to dispersed polymers and to determine the effect of additives on adhesion of polymers to films. Studied are aqueous dispersions of VCl2/AN dispersed with ionic surfactant, and of VCl2/AN/alkylacrylate, which was dispersed with nonionic surfactant. Polyethylene terephthalate was used as a base film for this work. Author

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N71-25670# Technische Univ., Berlin (West Germany). Inst. fuer Raumfahrttechnik.
THE BENEFIT OF SPACE RESEARCH FROM THE GERMAN POINT OF VIEW: A MACRO MODEL FOR ESTIMATING THE MAGNITUDE OF SPACE RESEARCH BENEFITS FOR THE FEDERAL REPUBLIC OF GERMANY, PART 1 [UEBER DEN NUTZEN DER WELTRAUMFORSCHUNG AUS DEUTSCHER SICHT: EIN MAKROMODELL FUER DIE ABSCHAETZUNG DER GROESSENORDNUNG DES AUS DER WELTRAUMFORSCHUNG ABLEITBAREN NUTZENS FUER DIE BRD, TEIL 1]
H. H. Koelle, G. Ehinger, F. Heidtmann, F. Lienemann, G. Niederau et al Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Jan. 1971 180 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-71-01-Pt-1) Avail: NTIS; ZLDI Munich: 37.80 DM

An attempt to develop a cost-benefit model for space programs of the German Federal Republic is described. The purpose of the model is to provide a decision aid for planning the German space program. The aim of this effort is to determine the benefit of space projects in their magnitude and trends. Furthermore the cost-benefit ratios of alternative space programs are investigated and described. This volume is the first of four and describes the methods used and the results obtained. Author (ESRO)

N71-28671# Technische Univ., Berlin (West Germany). Inst. fuer Raumfahrttechnik.
THE BENEFIT OF SPACE RESEARCH FROM THE GERMAN POINT OF VIEW: A MACRO MODEL FOR ESTIMATING THE MAGNITUDE OF SPACE RESEARCH BENEFITS FOR THE FEDERAL REPUBLIC OF GERMANY, PART 2 [UEBER DEN NUTZEN DER WELTRAUMFORSCHUNG AUS DEUTSCHER SICHT: EIN MAKROMODELL FUER DIE ABSCHAETZUNG DER GROESSENORDNUNG DES AUS DER WELTRAUMFORSCHUNG ABLEITBAREN NUTZENS FUER DIE BRD, TEIL 2]
H. H. Koelle, G. Ehinger, F. Heidtmann, F. Lienemann, G. Niederau et al Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Jan. 1971 263 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-71-02-Pt-2) Avail: NTIS; ZLDI Munich: 55.25 DM

An attempt to develop a cost-benefit model for space programs of the German Federal Republic is described. The purpose of the model is to provide a decision aid for planning the German space program. The aim of this effort is to determine the benefit of space projects in their magnitude and trends. Furthermore the cost-benefit ratios of alternative space programs are investigated and described. This volume is the second of four and describes the methodology as well as the term of benefit and the economical, scientific, and political-sociological field of benefit. Author (ESRO)

N71-25762# College of Aeronautics, Cranfield (England).
EFFECT OF RELEVANCE DECISIONS ON COMPARATIVE PERFORMANCE OF INDEX LANGUAGES Interim Report
Cyril Cleverdon [1970] 15 p refs
(OSTI-5049) Avail: NTIS

Experimental testing of information retrieval subsystems must always involve comparison of a single variable. The subject areas of the document collection can influence the relative performance of index languages but the effect has not yet been shown to be as great as might be expected. The possibility that comparisons might be affected by a new set of relevance decisions as made by a person of reasonable competence in the subject field was investigated and the hypothesis that the relevance decisions did not significantly affect the comparative results of Cranfield 2 was confirmed. ESRO

N71-25761*# National Aeronautics and Space Administration, Washington, D.C.
COMMUTERS, STAY HOME AIAA Paper No. 71-490
Gifford A. Young 1971 11 p refs Presented at Urban Technol. Conf., New York, 24–26 May 1971; sponsored by AIAA and Astronaut. Intern. City Management Assoc., Natl. League of Cities,

and US Conf. of Mayors, Inc.
(NASA-TM-X-67243) Avail: NTIS CSCL 05K

Commuting imposes serious cost, time, and social burdens on individuals and society. It should not be considered primarily as a transportation problem but as a part of a complex economic and behavioral system in which the functions and structure of the work location and the commuter's residence are of greater import. A potential alternative to routine commuting is the concept of remote work by which a worker conducts office-type activities in his house or apartment or through a neighborhood work and telecommunications center, yet travels to his employer's office at appropriate times for orientation and motivation. A development program to demonstrate the effectiveness of remote work, evaluate its impact on economic and social patterns, and promote phased implementation is proposed. Author

N71-26003*# California Univ., Berkeley. Space Sciences Lab.
DESIGN OF INQUIRING SYSTEMS/SINGERIAN INQUIRING SYSTEMS. CHAPTER 7
C. West Churchman Oct. 1970 29 p refs *Its* Internal Working Paper No. 122
(Grant NGL-05-003-404)
(NASA-CR-118631) Avail: NTIS CSCL 05F

The inquiring system used in metrology is discussed from a philosophical point of view. Standards and units, performance of the measuring system, readings and replications, and revisions are considered. The discussion is based on the writings of E. A. Singer, and specifically his "Experience and Reflection". E.H.W.

N71-26041* + National Aeronautics and Space Administration, Washington, D.C.
SIGNIFICANT NASA INVENTIONS. AVAILABLE FOR LICENSING IN FOREIGN COUNTRIES
1971 45 p refs
(NASA-SP-7038) Avail: SOD $0.30; NTIS CSCL 05B

Abstracts are presented of those inventions in which NASA owns the principal or exclusive rights and which have been made available for patent licensing in various foreign countries. Each abstract is accompanied by a list of the countries granted availability and the corresponding U.S. patent number. D.L.G.

N71-26052*# National Aeronautics and Space Administration, Washington, D.C.
CURRENT SHUTTLE STATUS
C. J. Donlan *In its* NASA Space Shuttle Technol. Conf., Vol. 1 Apr. 1971 p 1-15 (See N71-26051 14-31)
Avail: NTIS HC $9.00/MF $0.95 CSCL 05A

Space shuttle cost trends per pound of payload are defined for current transportation systems ranging in size from the Scout to the Saturn V. Technical performance requirements, engine size, and vehicle configurations are assessed, mobilization of people and resources and a broad technology program are outlined, and a current space shuttle planning schedule involving a delta-type orbiter with single vertical tail and associated canard-type booster configurations is presented. G.G.

N71-26116# Royal Aircraft Establishment, Farnborough (England).
CABTRACK STUDIES: ASSESSMENT OF AUTOTAXI URBAN TRANSPORT SYSTEMS
Jan. 1969 207 p refs
(RAE-TR-68287-Pt-2) Copyright. Avail: NTIS

CONTENTS:

1. SUMMARY OF EXISTING PROPOSALS A. F. Hammond p 5-24 refs (See N71-26117 34-14)

2. SOME EXPERIMENTS TO DETERMINE ACCELERATION LIMITS FOR PASSENGER COMFORT D. I. Paddison p 25-26 refs (See N71-26118 04-14)

3. THE INFLUENCE OF ACCELERATION LIMITS ON SPACE NEEDED TO PERFORM MANOEUVRES D. I. Paddison p 27-40 (See N71-26119 34-14)

4. TRAVEL FROM B.R. STATIONS INTO CENTRAL LONDON DURING THE MORNING RUSH HOUR M. G. Langdon p 41-43 (See N71-26120 34-14)

5. PEAK AND 24-HOUR DEMAND MATRICES FOR CENTRAL LONDON NETWORKS D. Catherall p 45-60 refs (See N71-26121 34-14)

6. ROUTE FINDING THROUGH RECTANGULAR NETWORKS D. Catherall p 61-64 (See N71-26122 34-14)

7. DISTANCES WALKED TO CABTRACK STATIONS ON A SQUARE NETWORK D. Catherall p 65-66 (See N71-26123 34-14)

8. TRACK/AIR-LINE DISTANCE RATIOS FOR RECTANGULAR MESHES D. Catherall and J. M. Clark p 67-70 (See N71-26124 34-14)

9. JOURNEY TIMES FOR VARIOUS TRAVEL MODES M. G. Langdon and J. M. Clark p 71-78 refs (See N71-26125 34-14)

10. PROBABLE QUEUE LENGTHS FOR MERGING EXAMPLE OF SECTION 8.2.4.(c) D. I. Paddison p 79-81 (See N71-26126 19-14)

11. CABTRIP PLANNING BY CENTRAL COMPUTER D.Catherall p 83-86 (See N71-26127 34-14)

12. SURVEY OF HARDWARE FOR CONTROL A. F. Hammond p 87-121 refs (See N71-26128 34-14)

13. AERODYNAMIC FORCES ON AUTOCABS K. T. Shaw p 123-128 refs (See N71-26129 01-14)

14. STABILITY OF AUTOCABS K. T. Shaw p 129-136 (See N71-26130 34-14)

15. AUTOCAB POWER REQUIREMENTS K. T. Shaw p 137-143 refs (See N71-26131 34-14)

N71-26117# Royal Aircraft Establishment, Farnborough (England).
SUMMARY OF EXISTING PROPOSALS, APPENDIX A
A. F. Hammond *In its* Cabtrack Studies: Assessment of Autotaxi Urban Transport Systems Jan. 1969 p 5-24 refs (See N71-26116 14-34)
Copyright. Avail: NTIS

The design and characteristics of small, single and multiple occupant tracked vehicles for improved urban transportation are presented. The peak capacity, allocation of vehicles, traffic control, and routing are described. Author

N71-26119# Royal Aircraft Establishment, Farnborough (England).
THE INFLUENCE OF ACCELERATION LIMITS ON SPACE NEEDED TO PERFORM MANOEUVRES, APPENDIX C
D. I. Paddison *In its* Cabtrack Studies: Assessment of Autotaxi Urban Transport Systems Jan. 1969 p 27-40 (See N71-26116 14-34)
Copyright. Avail: NTIS

The effects of acceleration on the space required to perform maneuvers with small tracked vehicles used in urban transportation are discussed. Four maneuvers are considered: (1) speed change from one constant speed to another, (2) headway change of speed in which initial and final speeds are the same, (3) right angle turns, and (4) side steps in which the vehicle changes from one track to a parallel track. The acceleration limit is considered to be 8 feet per second per second. Author

N71-26120# Royal Aircraft Establishment, Farnborough (England).
TRAVEL FROM BR STATIONS INTO CENTRAL LONDON DURING THE MORNING RUSH HOUR, APPENDIX D
M. G. Langdon *In its* Cabtrack Studies: Assessment of Autotaxi Urban Transport Systems Jan. 1969 p 41-43 (See N71-26116 14-34)
Copyright. Avail: NTIS

A statistical analysis of travel from central London, England commuter passenger terminals is presented. The purpose of the analysis is to determine transportation requirements as a planning factor for development of an improved urban transportation system.
P.N.F.

N71-28121# Royal Aircraft Establishment, Farnborough (England).
PEAK AND 24 HOUR DEMAND MATRICES FOR CENTRAL LONDON NETWORKS, APPENDIX E
D. Catherall *In its* Cabtrack Studies: Assessment of Autotaxi Urban Transport Systems Jan. 1969 p 45–60 refs (See N71-26116 14-34)
Copyright. Avail: NTIS

The steps taken to transform traffic demand figures from a traffic survey of London, England commuter requirements into station to station demand figures are discussed. The analysis is used as a planning factor in the development of an improved urban transportation system.
P.N.F.

N71-28122# Royal Aircraft Establishment, Farnborough (England).
ROUTE FINDING THROUGH RECTANGULAR NETWORKS, APPENDIX F
D. Catherall *In its* Cabtrack Studies: Assessment of Autotaxi Urban Transport Systems Jan. 1969 p 61–64 (See N71-26116 14-34)
Copyright. Avail: NTIS

Of all possible types of regular network, rectangular networks form the most important class in the Cabtrack context in the sense that Cabtrack networks superimposed on an existing urban environment will almost certainly have to be based mainly on a rectangular pattern because of existing street patterns. The types of route which will have to be made on the different rectangular networks are discussed. Some networks involve fairly short simple routes between two given stations on the network, while others involve in many cases rather circuitous routes. The objective of a route-finding computer program is to discover the optimum route from a given origin to a given destination station. For the networks considered below, all of which have a square mesh, an optimum route between two given points may be defined as one covering the shortest track distance with the fewest number of turnings.
Author

N71-28123# Royal Aircraft Establishment, Farnborough (England).
DISTANCES WALKED TO CABTRACK STATIONS ON A SQUARE NETWORK, APPENDIX G
D. Catherall *In its* Cabtrack Studies: Assessment of Autotaxi Urban Transport Systems Jan. 1969 p 65–66 (See N71-26116 14-34)
Copyright. Avail: NTIS

The average distance people must walk to a Cabtrack station when there is a square network of lines laid down on a rectangular street pattern is presented. Walking distances are derived as a function of mesh spacing under certain idealized assumptions, for the two cases of stations placed at intersections and stations placed mid-way between intersections. For both cases it is supposed that the distance between tracks is b and people are distributed evenly with, say, n people per unit area. It is further supposed that streets run parallel to the tracks and that there are a large number of narrow streets (in the limit an infinite number of streets with zero widths), so that from any given point people can walk only in directions parallel to the tracks.
Author

N71-28124# Royal Aircraft Establishment, Farnborough (England).
TRACK/AIR LINE DISTANCE RATIOS FOR RECTANGULAR MESHES, APPENDIX H
D. Catherall and J. M. Clark *In its* Cabtrack Studies: Assessment of Autotaxi Urban Transport Systems Jan. 1969 p 67–70 (See N71-26116 14-34)
Copyright. Avail: NTIS

When travelling from one station on a network to another, the distance actually traversed along the track will usually be greater than the air-line (or crow-fly) distance between the two stations. The ratio between the track distance and the air-line distance is based on the average value for a given air-line distance. Only regular rectangular networks are considered and it is assumed that the mesh spacing is small compared to journey distances, although it can be shown that even for short journeys (two or three links) the resultant values of distance are very close to the theoretical ones.
Author

N71-28126# Royal Aircraft Establishment, Farnborough (England).
JOURNEY TIMES FOR VARIOUS TRAVEL MODES, APPENDIX I
M. G. Langdon and J. M. Clark *In its* Cabtrack Studies: Assessment of Autotaxi Urban Transport Systems Jan. 1969 p 71–78 refs (See N71-26116 14-34)
Copyright. Avail: NTIS

When a passenger makes a trip between two points, using a particular mode of mechanical transport, the total time required for that trip will usually include time spent walking and waiting as well as the time spent riding in the mechanical transport. Total journey times are evaluated for journeys of different length in Central London, for the following modes: (1) private car, (2) bus, and (3) underground. Journey times if the entire journey is made by walking are included for comparison.
Author

N71-28127# Royal Aircraft Establishment, Farnborough (England).
CAB TRIP PLANNING BY CENTRAL COMPUTER, APPENDIX K
D. Catherall *In its* Cabtrack Studies: Assessment of Autotaxi Urban Transport Systems Jan. 1969 p 83–86 (See N71-26116 14-34)
Copyright. Avail: NTIS

The control systems for Cabtrack systems are primarily concerned with local control maintaining vehicle separation on the track, and allowing safe merging. The problem of a scheduling computer to oversee cab flows and help avoid congestion is discussed. Queues are inevitable somewhere in the system at some times because of the random nature of the demand, and these queues may occur at turnings, on the main track, or at stations, either in the form of a queue of cabs waiting to leave the station, or of a queue of passengers waiting to board cabs. Congestion and traffic jams, leading to a reduction in the overall running efficiency of the system, result from permitting queues to form on the main track or at turnings, and to avoid this some form of central planning is necessary. The problem of whether queues of cabs or queues of passengers waiting for cabs form at stations may be handled by a station computer, which can restrict the number of passengers passing through the station barriers to a level which can be handled by the available cabs, and can call in empty cabs to accommodate the passenger demand. Different levels of central planning are possible and the extreme form of complete pre-planning of routes and track occupancy by a central computer is considered.
Author

N71-28128# Royal Aircraft Establishment, Farnborough (England).
SURVEY OF HARDWARE FOR CONTROL, APPENDIX L
A. F. Hammond *In its* Cabtrack Studies: Assessment of Autotaxi Urban Transport Systems Jan. 1969 p 87–121 refs (See N71-26116 14-34)
Copyright. Avail: NTIS

The automatic control of road and rail transport, and equipment for general and specific application is discussed. Much of this equipment could be used in Cabtrack control systems if required, although some repackaging or reduction in size would be necessary in some cases to provide units acceptable for mounting within the cab. The survey of available equipment has been extended to include

experimental and proposed apparatus which could reasonably be expected to be brought up to production standard within a few years. A brief description with remarks on advantages and disadvantages is given for each with some indication of size, cost and power requirements. Author

N71-26130# Royal Aircraft Establishment, Farnborough (England).
STABILITY OF AUTOCABS, APPENDIX N
K. T. Shaw *In its* Cabtrack Studies: Assessment of Autotaxi Urban Transport Systems Jan. 1969 p 129–136 (See N71-26116 14-34)
Copyright. Avail: NTIS

The minimum size of an Autocab will be limited not only by the dimensions required to provide adequate passenger accommodation and motive power, but also by the dimensions of wheelbase and track required to provide adequate stability under the most adverse conditions of acceleration, gradient, wind force and center of gravity position. Stability will also be affected by other factors such as suspension and wheel characteristics, but in this analysis the vehicle will be assumed rigid. The effect of the various loading parameters on minimum requirements for track and wheelbase will be studied, only lateral and longitudinal stability being considered. Author

N71-26131# Royal Aircraft Establishment, Farnborough (England).
AUTOCAB POWER REQUIREMENTS, APPENDIX O
K. T. Shaw *In its* Cabtrack Studies: Assessment of Autotaxi Urban Transport Systems Jan. 1969 p 137–143 refs (See N71-26116 14-34)
Copyright. Avail: NTIS

The performance requirements of an Autocab are discussed. The probable resistance to motion of an Autocab is examined in detail, and power requirements estimated for acceleration and constant speed running under various adverse conditions. Author

N71-26164# Joint Publications Research Service, Washington, D.C.
DEVELOPMENTS IN CZECHOSLOVAK SCIENTIFIC AND TECHNICAL INFORMATION
5 May 1971 18 p Transl. into ENGLISH from Nauchn.-Tekhn. Inform. (Moscow), no. 11, 1970 p 13–17
(JPRS-53047) Avail: NTIS

CONTENTS:

1. PLANNED DEVELOPMENT OF CZECHOSLOVAK INFORMATION SYSTEM p 1–9 (See N71-26165 14-34)

2. CZECHOSLOVAK SCIENTIFIC, TECHNICAL POPULARIZATION SYSTEM M. Shuska p 10–17 (See N71-26166 14-34)

N71-26165# Joint Publications Research Service, Washington, D.C.
PLANNED DEVELOPMENT OF CZECHOSLOVAK INFORMATION SYSTEM
In its Develop. in Czech. Sci. and Tech. Inform. 5 May 1971 p 1–9 (See N71-26164 14-34)
Avail: NTIS

A complete integrated information system incorporating an international data bank is discussed. This system is for providing information so that duplicate scientific research may be eliminated in Czechoslovakia. J.A.M.

N71-26166# Joint Publications Research Service, Washington, D.C.
CZECHOSLAVAK SCIENTIFIC, TECHNICAL POPULARIZATION SYSTEM
M. Shushka *In its* Develop. in Czech. Sci. and Tech. Inform. 5 May 1971 p 10–17 (See N71-26164 14-34)
Avail: NTIS

The history of the information services in Czechoslovakia is given. The advantages of the payment system of implementing measures, which provide material control of scientific organizations and ensures economy in conducting events, are compared to the popularization system. The main theories of popularization include: (1) dissemination and explanation of advanced production know-how, (2) cooperative organization between workers in science and production, (3) mastery of new disciplines, and (4) exchange of ideas. J.A.M.

N71-26193# Library of Congress, Washington, D.C. Science Policy Research Div.
UNITED STATES AND SOVIET PROGRESS IN SPACE: SOME NEW CONTRASTS
Charles S. Sheldon, II 12 Jan. 1971 75 p
(Rept-71-25-SP) Avail: Issuing Activity

A brief history of U.S. and U.S.S.R. developments in space technology is presented. Various aspects of the two programs are compared including supporting resources for space flight, manned flight, military versus civilian space activities, space applications flights, and lunar and planetary efforts. Future directions for the space programs are also discussed. J.M.

N71-26328# Air Force Cambridge Research Labs., Bedford, Mass.
PROCEEDINGS OF THE LAG HANSCOM FIELD SCIENCE AND ENGINEERING AWARDS MEETING
Henry Novak, comp. 15 Dec. 1970 159 p refs Conf. held at Bedford, Mass., 3 Nov. 1970 *Its* Spec. Rept. No. 112
(AD-720248; AFCRL-70-0706) Avail: NTIS CSCL 4/1

A first-order prediction model of total-electron-content group path delay for a midlattitude ionosphere; Negative ion-neutral reactions; Some concepts and designs for highly parallel high-speed arithmetic units; Acoustic surface wave investigations and devices for air force applications; Earth environmental noise fields; Analysis, design, and testing of radiation hardened semiconductor devices; A new silicon avalanche infrared photodetector for the 1- to 2-micrometer region; New directions in human factors engineering for military information systems(Automated training systems); A time dependent map formulation to project subsatellite traces as nearly straight lines; and A multifunctional target signature identification and data compaction technique. GRA

N71-26451# Bell Aerospace Co., Tucson, Ariz.
REPORT ON THE OPERATIONS OF THE ENVIRONMENTAL DATA COLLECTION AND PROCESSING FACILITY (EDCPF) Progress Report, 1 Oct. –31 Dec. 1970
T. J. Fishle, H. F. Warren, D. M. Carnine, R. F. Dolan, E. W. Smith et al Mar. 1971 53 p
(Contract DAAB07-71-C-0010)
(AD-720592; A70009-739; Rept-69; PR-2) Avail: NTIS CSCL 5/2

A summary of the tasks assigned to the EDCPF is given and the progress and status of these tasks are outlined. The tasks covered are: project management and general support; operation, maintenance, and enhancement of the C-E Environmental Simulation System, the General Retrieval and Display System, and the Data Base Maintenance and Update System; operational support as directed by the ED; frequency management support provided to the ED by the Washington Engineering Group; development of a Management Information and Control System; updating of data base files for the U. S. and opposing forces; development of new C-E environments; and conferences attended by EDCPF personnel. Author (GRA)

N71-26470 Texas A&M Univ., College Station.
A FINITE ELEMENT STUDY OF THE PENETRATION OF A

SOIL HALF-SPACE BY A RIGID PROJECTILE
Gary Neil Reeves (Ph.D. Thesis) 1969 82 p
Avail: Univ. Microfilms Order No. 70-11575

The finite element method is employed to model a soil half-space by the generation of an axisymmetric body of revolution. From the finite element grid, strain energy is calculated from selected input soil parameters as the projectile penetrates the half-space. Using the nodal points in the element grid as a finite difference grid in cylindrical coordinates, the transfer of momentum from the projectile to the soil half-space is calculated in the form of inertial energy. The calculation of strain and inertial energies is done on a time increment basis. At the end of each increment, the sum of the energy put into the soil medium is subtracted from the kinetic energy of the projectile. This process continues until the projectile is stopped. The result of this operation is an ensemble of depth, velocity, force, and transfer of energy relations, each obtained as a function of time. Dissert. Abstr.

N71-26636*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
A SELECTIVE LIST OF ACRONYMS AND ABBREVIATIONS
Feb. 1971 171 p refs Revised
(NASA-TM-X-67197; KSC-GP-589-Rev) Avail: NTIS CSCL 05B

An updated list of acronyms and abbreviations generally in use at the Kennedy Space Center is presented. More than 9500 entries are identified. Author

N71-26572# Advisory Group for Aerospace Research and Development, Paris (France).
AGARD BULLETIN: TECHNICAL PROGRAM, 1972
May 1971 25 p refs
(AGARD-BUL-71/2; AGARD-BULL-71-2) Avail: NTIS

The contents and scope are reported of the AGARD technical program and budget for 1972 as approved by the National Delegates Board. The information contained includes: (1) a calender of meetings, (2) a calender of publications, (3) a summary of the budget, and (4) program descriptions. D.L.G.

N71-26595# Forsvarets Forskningsanstalt, Stockholm (Sweden).
MATHEMATICAL INVESTIGATION OF A METHOD FOR DETERMINING PROJECTILE OSCILLATION ANGLE AT A POINT ON ITS TRAJECTORY [MATEMATISK UNDERSOEKNING AV EN METOD FOER BESTAEMNING AV PROJEKTILERS PENDLINGSVINKEL I EN PUNKT PA BANAN]
Staffan Hoeijer Oct. 1969 49 p ref In SWEDISH
(FOA-2-C-2351-45) Avail: NTIS

In order to estimate a projectile's oscillation angle, (the angle between the projectile axis and the tangent to the line of flight) at a point on its course, the following method can be used. The projectile is illuminated from above so that the shadow falls on a light, inclined paper background. By photographing this, a picture is obtained where both the projectile and its shadow are recorded. An analysis of the picture gives the oscillation angle at the moment of photography. The sources of error and corrections that need to be made are also discussed. Author

N71-26656 Texas A&M Univ., College Station.
INVESTIGATION OF GAS SPECIES GENERATION BY ELECTRICALLY EXPLODING WIRES AT LOW PRESSURE
Leslie Merlin Bagnall (Ph.D. Thesis) 1969 38 p
Avail: Univ. Microfilms Order No. 70-11527

A series of aluminum and nickel-chrome wires, 10.5 inches in length and from 0.008 to 0.030 inches in diameter, were exploded and the gases in the chamber before and after the explosion were determined using a time of flight mass spectrometer. The wire was exploded in air, or the chamber was flushed with Ar or N2 prior to the explosion. Pressure in the tube at the time of ignition was varied from 0.02 to 0.28 torr. It was found that the rather large pressure increases after the explosion were caused by increases in or appearances of certain gases, most notably H2, C, and NO, concurrent with the large energy input of the explosion. The amount of certain other gas species tended to decrease somewhat with the explosion, particularly H2O and OH. Although metallic vapors from the wires were almost nonexistent, weighing of the wires and the chamber residue showed up to 70% of the original wire mass gone, indicating that the wire burst into small particles of molten metal. Dissert. Abstr.

N71-26777# Committee on Science and Astronautics (U. S. House).
NASA AUTHORIZATION, 1972, PART 1
Washington GPO 1971 850 p refs Hearings on H.R. 3981 (Superseded by H.R. 7109) before Comm. on Sci. and Astronaut., 92d Congr., 1st Sess., No. 2, 2–4, 9–11, and 16 Mar. 1971
Avail: Comm. on Sci. and Astronaut.

NASA presentations to the Committee on Science and Astronautics of the U.S. House of Representatives are reported. The hearings were held during the period March 2 to March 16, 1971. Subjects discussed included: (1) report on Apollo 14 flight, (2) financial appropriations for fiscal year 1972, (3) space missions, (4) spacecraft development, (5) space biology and human factors engineering, and (6) utilization of space technology by other components of society. P.N.F.

N71-26799# Committee on Aeronautical and Space Sciences (U.S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1972, PART 2
Washington GPO 1971 429 p refs Hearings on S. 720 before Comm. on Aeron. and Space Sci., 92d Congr., 1st Sess., 2 and 5 Apr. 1971
Avail: Comm. on Aeron. and Space Sci.

The continuation of the hearings on the NASA appropriations for 1972 is presented. Testimony concerning aeronautical research and development, DOD space and space-related programs, advanced research and technology programs, space nuclear systems, and tracking and data acquisition are reported. F.O.S.

N71-26800# Committee on Aeronautical and Space Sciences (U.S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1972, PART 1
Washington GPO 1971 713 p refs Hearings on S. 720 before Comm. on Aeron. and Space Sci., 92d Congr., 1st Sess., 30 Mar.–1 Apr. 1971
Avail: Comm. on Aeron. and Space Sci.

Testimony concerning NASA appropriations for fiscal year 1972 are reported. NASA requested an authorization of approximately $3.3 billion for continuing the programs of Apollo 15, 16, and 17; unmanned flights to Venus, Mercury, and Mars; applications satellite programs; and for new programs including space shuttle, space observatory, long-range exploration of the outer planets, and development of an experimental jet short-takeoff-and-landing research airplane with quiet engines. The Earth Resources Program, university funding, and facility construction were also discussed. F.O.S.

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